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MODEL TTS 59C

UNIVERSAL SENDER

INSTALLATION AND OPERATION

Northeast Electronics Instruction Manual
A0059-30-600 Issue 3 May 1979

northeast electronics
DIVISION OF tau-tron inc.
A UNIT OF GENERAL SIGNAL

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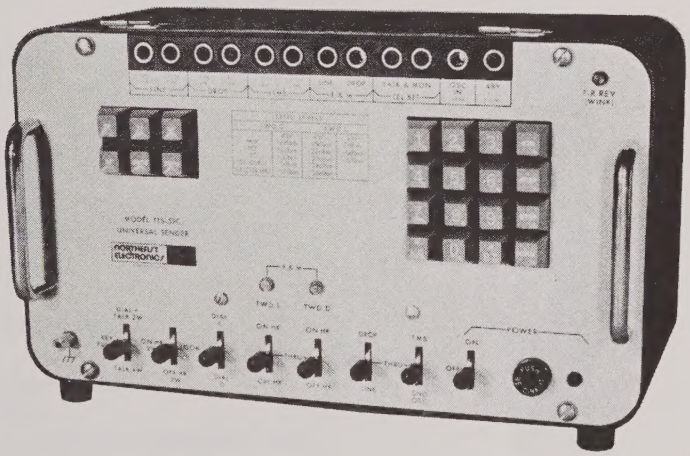

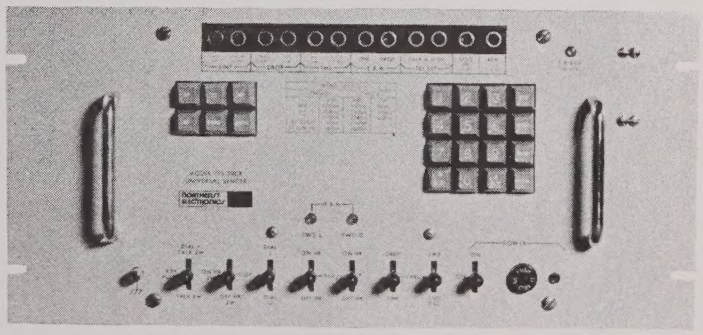

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SECTION 1

GENERAL DESCRIPTION

1.1 This manual describes the Northeast Electronics Model TTS 59C Universal Sender. This test set generates supervisory and address signaling used in testing various types of telephone circuits. The set includes access and switching features that permit both sending and receiving.

1.2 Provisions are also made for connection of external oscillators and transmission measurement sets (TMS) through the TTS 59C to a circuit under test. A combination of the TTS 59C and a two-way TMS (such as the Northeast Electronics Model TTS 44) allows accessing and as necessary, communicating with the far end circuit during transmission tests.

1.3 The Model TTS 59C is a portable unit, enclosed by a metal housing and a protective cover.

1.4 A row of jacks across the upper edge of the front panel accepts 310-type plugs for patching to test bays, a power source, and auxiliary external instruments. A row of lever switches across the bottom of the panel controls routing of supervisory, address, and information signals. A six-button array at the left center of the panel is used to select the type of address signaling. The 16-button keypad allows selection of dialing digits and multifrequency (MF) codes. Indicators are provided to show the states of loop and E&M circuits.

1.5 **Supervisory Signaling** towards either the line or the drop is possible in three modes.

- ☐ Loop
- ☐ E&M
- ☐ SF (2400 or 2600 Hz)

1.6 **Address Signaling** toward either the line or drop is possible in five modes.

- ☐ Loop dc pulsing
- ☐ E&M dc pulsing
- ☐ SF tone pulsing (2400 or 2600 Hz)
- ☐ MF
- ☐ DTMF (dual-tone multifrequency, also named Touchtone® or Digitone® . Referred to in this manual as TT.)

® Registered trademark

The loop pulsing, E&M pulsing, and SF tone pulsing are set at 10 pps, 61 percent break. The E&M sending function can be internally programmed to provide any combination of open, ground, or battery as on-hook and off-hook conditions. Thus, type I, II, and III E&M signaling can easily be accomodated. The MF address signaling can be used with any of the three supervisory modes. The TT signals can also be used as information tones, such as those sent into computerized banking equipment.

1.7 Voice communication can be established with either the line or drop on two-wire or four-wire circuits. The test set accepts a type 52A, or equivalent, telephone headset for this purpose. The headset can also be used to monitor in-band tone signals sent to a circuit under test by the test set. Two-way transmission test signals can also be connected through the test set. Pads in the test set are switched to inject appropriate levels into line and drop directions on two-wire or four-wire circuits.

1.8 TYPICAL APPLICATIONS.

1.9 The Model TTS 59C Universal Sender has capabilities needed for:

- ☐ Acceptance testing of new installations,
- ☐ Routine testing of in-service installations, and
- ☐ Trouble diagnosis/sectionalizing.

The test set interfaces with trunk circuits through VF patch bays and patching jack bays such as two-wire, four-wire, and six-wire patch bays. The many sending modes, including the programmable E&M mode, make the set usable with most trunk types.

1.10 INPUT POWER.

1.11 The TTS 59C operates from −48 Vdc central office battery at a load current of approximately 500 milliamperes. Power is applied to the set through a 310-type jack. The power switch, circuit breaker, and power indicator are clustered at the lower right corner of the front panel.

1.12 FUNCTIONAL DESCRIPTION.

1.13 Signal connections and internal switching are shown in a simplified, general manner on Figure 1−1. Although signals are actually switched by relays controlled from the front panel, circuits are shown as

if only panel switches are used. An understanding of the test set can be gained more readily with this simplified approach. An inset on Figure 1—1 identifies the major functional sections of the test set which are discussed in the following paragraphs.

1.14 The VF circuit under test switching function accepts two-wire or four-wire line and drop, send and receive VF connections via J9 through J12. Routing of signals to and from these connections is controlled by DROP/THRU/LINE switch S3 as follows:

- ☐ In THRU: Receive circuits are switched to send circuits (J9 to J11 and J12 to J10). Signals at the LINE jacks are bridged by the monitor function through R_A and R_B.
- ☐ In DROP: The LINE jacks (J11 and J12) are terminated. The DROP REC 4W jack (J9) is switched to the measurement function. The DROP SEND 4W jack (J10) is switched to the test signal switching function. The DROP jacks (J9 and J10) are bridged by the monitor function through R_A and R_B.
- ☐ In LINE: The DROP jacks (J9 and J10) are terminated. The LINE REC 4W jack (J12) is switched to the measurement function. The LINE SEND jack (J11) is switched to the test signal switching function. The LINE jacks (J11 and J12) are bridged by the monitor function through R_A and R_B.

1.15 The test signal switching function selects either a headset transmitter, an external oscillator, an external TMS instrument, internal in-band tone signal, or internal loop dial pulses for sending into the circuit under test via DROP/THRU/LINE switch S3. The headset transmitter is enabled in either TALK positions of the DIAL + TALK 2W/KEY PULSE/TALK 4W switch S8. The in-band tone signaling is enabled only in the KEY PULSE positions. An external oscillator or TMS instrument can be connected through J2 or J7 to TMS/THRU/SND OSC switch S2. A relay (shown at the left-hand side of the PADS block) senses tip-ring reversals on loop circuits under test and controls the T-R REV (WINK) indicator. Internally generated pulses control the relay for pulsing into a loop circuit under test.

1.16 The pads on Figure 1—1 act as follows:

- ☐ 0 dB: Used for all operations toward the drop except in-band supervision; used for two-wire talk toward the line, including loop supervision and dialing.
- ☐ 7 dB: Used for two-wire transmission loss tests and in-band address tone signaling toward the line.
- ☐ 16 dB: Used for four-wire talk toward the line.
- ☐ 23 dB: Used for four-wire transmission loss tests and in-band address tone signaling toward the line.
- ☐ X + 12 dB: Used for in-band (SF) supervision. X = 0, 7, or 23 dB.

When an oscillator is set to supply +7 dBm to the TTS 59C, the pads deliver the correct levels to the circuit under test. Note that incoming signals from the line side of a two-wire circuit under test can be delivered to TMS jack J7 (for measurement) and also to the internal monitor function.

1.17 The monitor and measurement function accepts signals from the line or drop side of a circuit under test, as selected by the DROP/THRU/LINE switch S3. These signals are combined (mixed) by R_A and R_B then amplified and switched to a headset receiver when the DIAL + TALK 2W/KEY PULSE/TALK 4W switch S8 is at KEY PULSE.

1.18 When switch S8 is at TALK 4W (and TMS/THRU/SND OSC switch S2 is at THRU) the headset receiver is connected to the selected REC jack (J9 or J12) through the measurement function. The headset is connected to the test signal switching function when the DIAL + TALK 2W/KEY PULSE/TALK 4W switch S8 is at DIAL + TALK 2W to complete the two-wire circuit. (A muting function disables the headset receiver during dial pulsing when the DIAL + TALK 2W/KEY PULSE/TALK 4W switch S8 is in either TALK positions.)

1.19 The measurement function:

(1) switches the selected REC jack to the TMS REC 4W jack (TMS/THRU/SND OSC switch S2 at TMS),

(2) terminates the selected REC jack (TMS/THRU/SND OSC switch S2 at THRU and DIAL + TALK/KEY PULSE/TALK 4W switch S8 at DIAL + TALK 2W),

(3) connects a four-wire circuit under test to the monitor as described previously.

1.20 The internal signal generator delivers dial pulses to the internal two-wire loop function and to the internal E&M switching function. Tones (SF, MF, or TT) are supplied to the test signal switching function. The in-band signal **mode** is determined by the six-button array. **Content** is determined by the keypad.

1.21 The E&M switching function is shown at the lower right in Figure 1—1. If the E&M TWD. L and TWD. D switches S5 and S4 are at THRU and the DIAL L/CENTER/DIAL D switch S6 is at the CENTER position, the line E&M leads are carried through to the drop E&M leads. The E-lead and the M-lead are independently controlled by switches S4 and S5 respectively. The drop M and line E leads are always monitored. Indicators show the E&M status. Thresholds in the monitor permit detection of voltage faults on these lines.

1.22 Signaling to a circuit under test is initiated by moving either the TWD. L or TWD. D switch out of the THRU position. A voltage representing the off-hook condition is switched forward in the OFF HK position. With the DIAL L/CENTER/DIAL D switch S6 at DIAL L (or at DIAL D going toward the drop), the off-hook voltage is replaced with dial pulse voltages. Voltages representing the on-hook condition are switched forward with the TWD. L and TWD. D switches at ON HK. The on-hook and off-hook voltages can be internally set to meet the needs of various trunk circuit types such as types I, II, III.

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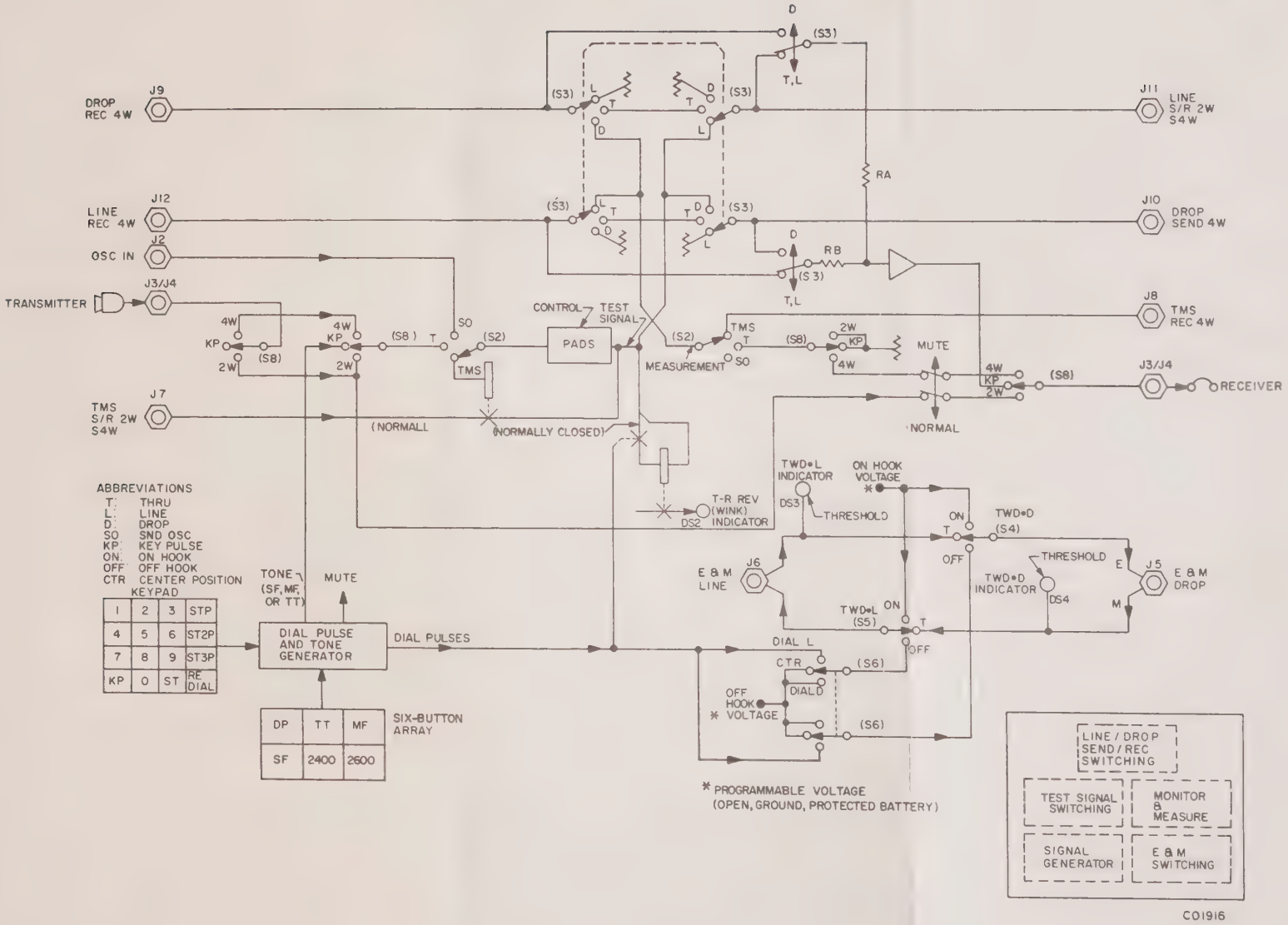

Figure 1–1. Model TTS 59C General Block Diagram.

SECTION 2

SPECIFICATIONS

2.1 Table 2—1 lists the specifications of the Model TTS 59C Universal Sender.

Table 2—1. Model TTS 59C Specifications.

DIAL PULSE GENERATOR

Frequency:	10 ± 1 pps
Percent break:	61 ± 6%
Interdigit time:	780 ± 50 msec
Digit storage capacity:	up to 16 digits (DP or SF only)

IN-BAND TONE SIGNALING

Frequencies:	Standard MF, TT, plus 2400 Hz and 2600 Hz SF
Frequency accuracy:	± 1%
Total harmonic distortion:	at least 30 dB below fundamental per tone

OUTPUT LEVELS:

OUTPUT TYPE	LEVEL		
	DROP SEND 4W	LINE S/R 2W S4W	
		4W	2W
MW (+7 dBm at J2)	+7 dBm	− 16 dBm	0 dBm
MF	+1 dBm	− 22 dBm	− 6 dBm
TT	+1 dBm	− 22 dBm	− 6 dBm
SF (DIAL)	− 1 dBm	− 24 dBm	
SF (ON HK)	− 13 dBm	− 36 dBm	

OUTPUT LEVEL ACCURACY:	± 1.0 dB
OUTPUT IMPEDANCE:	600 ohms ± 5%
INPUT IMPEDANCE:	600 ohms ± 5%
BRIDGING IMPEDANCE:	100 Kohms, minimum
POWER REQUIREMENT:	− 48 Vdc at approximately 500 milliamperes
DIMENSIONS (TTS 59C):	14 in w × 8¾ in h × 8 in d (35.6 cm × 22.2 cm × 20.3 cm)

Table 2—1. (Cont'd).

WEIGHT (TTS 59C):	13 lbs. (5.9 kg)
OPERATING TEMPERATURE RANGE:	0°C to +50°C (+32°F to +122°F)
OPERATING RELATIVE HUMIDITY:	0 to 95% non-condensing

SECTION 3

INSTALLATION

3.1 INITIAL INSPECTION.

3.2 The unit was carefully inspected, both mechanically and electrically, before shipment. It should be operating correctly when received. To confirm this, visually inspect the unit for signs of damage during shipment. If desired, the confidence tests presented in paragraphs 4.29 through 4.36 can be used to check operation. If damage from transit is found, notify the common carrier immediately.

3.3 SERVICE INFORMATION.

3.4 Complete warranty information is contained in the purchase order agreement under terms and conditions of sale. Summarized briefly, the Northeast Electronics warranty extends for a period of one year to the original purchaser of a Northeast test instrument. Northeast's system products are covered by a special warranty which can be summarized as follows.

- ☐ Hardware items are warranted for a period of 90 days.
- ☐ Software items are warranted for a period of one year.

3.5 It is recommended that Northeast's Repair Department be contacted for assistance, if, for any reason, a Northeast product fails to perform as expected. This step eliminates the needless delay entailed when a product is returned unnecessarily. Contact the Repair Department at Northeast Electronics P.O. Box 2021, Concord, New Hampshire 03301, telephone: (603) 228-3700.

3.6 If a Northeast Electronics product requires factory servicing **during** the warranty period, be sure to include a ship-to-address and a description of the problem when returing the product to Northeast Electronics. **After** the warranty period has expired, equipment returned must be accompanied by all of the following:

- ☐ The number of the purchase order covering the cost of servicing,
- ☐ Bill-to-address,
- ☐ Ship-to-address,
- ☐ Description of problem.

3.7 In all cases, equipment requiring factory servicing should be sent to the Repair Department at the preceding address and telephone number. A return material authorization (RMA) number is **not** required, but will be provided by the Repair Department upon request.

3.8 TTS 59C POWER.

3.9 The TTS 59C operates from −48 Vdc central office battery at approximately 500 milliamperes. Power connection is made via a 310-type jack located on the front panel.

SECTION 4

OPERATION

4.1 Maximum utility of the Model TTS 59C Universal Sender can be realized only when a thorough understanding of the jack access and switching capabilities has been obtained. Therefore, it is recommended that the descriptive material given for test set controls and access jacks be carefully and thoroughly studied before attempting any operating procedures. In addition, the general operating considerations presented in paragraphs 4.4 through 4.28 are important, especially the instructions for programming the test set to meet interface requirements. The detailed operating instructions are illustrated to show the signal flow for each type of use.

4.2 CONTROLS, INDICATORS, AND JACKS.

4.3 All front panel controls, indicators, and jacks are identified in Figure 4—1. Table 4—1 lists the twelve 310-type access jacks located at the top center of the panel. The table is arranged to show the application of each jack and the internal incoming and outgoing connections made to each jack by various switching combinations. Table 4—2 lists seven of the eight lever switches. This table identifies the application of each switch, describes the influence of each switch on incoming and outgoing signals, and identifies all related switching requirements for each switch position. The address signal controls included in the six-button array and the sixteen-button keypad are described in Table 4—3. This table includes applications and related switching requirements. Voice frequency test conditions are summarized in Table 4—4. Table 4—5 describes the front panel indicators.

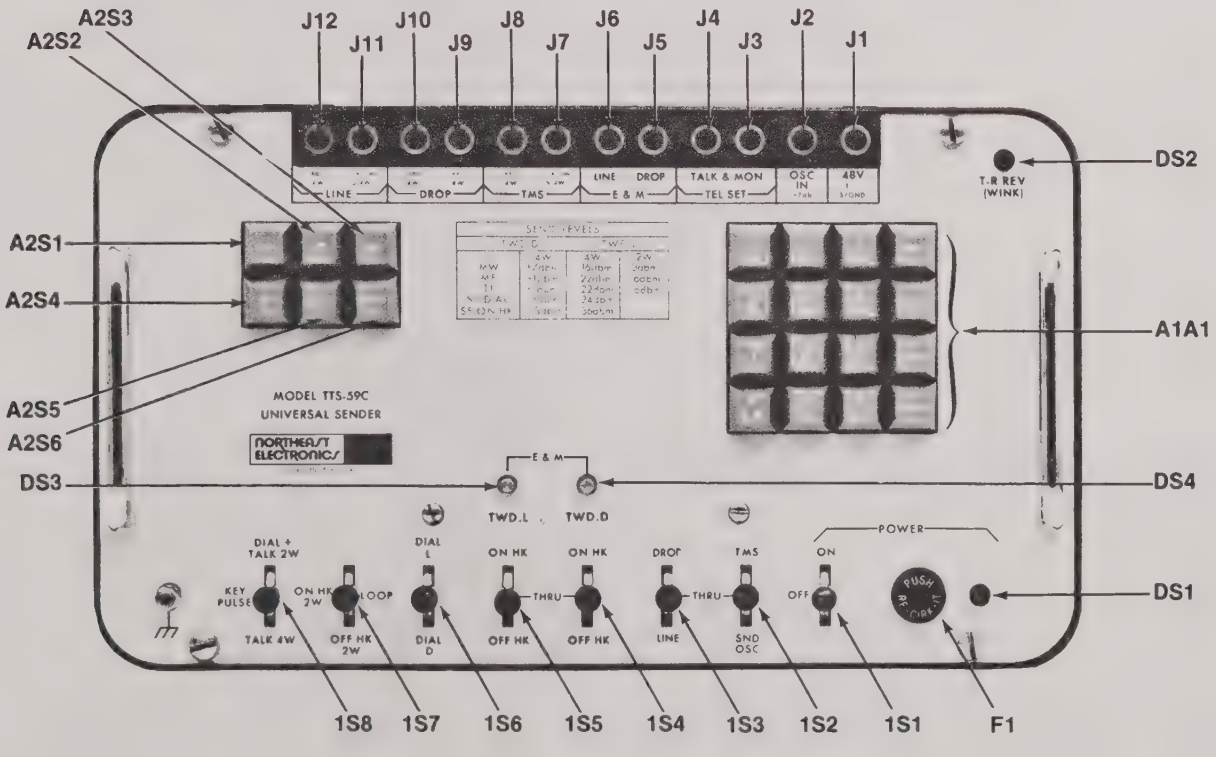

Figure 4—1. Model TTS 59C Operating Controls.

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Table 4—1. Model TTS 59C Front Panel Access Jacks.

REF DES	NOMENCLATURE	INCOMING		TEST SET APPLICATION(S)	OUTGOING	
		EXTERNAL SOURCE	SWITCHED TO		SWITCHED FROM	EXTERNAL DESTINATION
J1	48V, T = –, S = GN	Office or accessory supply	Test set circuits	All	Not applicable	Not applicable
J2	OSC IN +7 dB	Test oscillator; (appropriate levels delivered to circuit under test with +7 dBm input)	J11 or J10 (SEND) and J3/J4 (MON)	Transmission path loss and gain-slope tests	Not applicable	Not applicable
J3/J4	TEL SET TALK & MON	Transmitter of type 52A or equivalent telephone headset	J11 or J10 (SEND)	Sending: communication with far end Receiving: a. communication with far end b. through-connected VF circuit under test Monitor: a. external TMS or oscillator signal b. In-band supervisory and address signals	a. J12 or J9 (REC) b. J12 or J9 (REC) c. J2 (OSC) or J7 (TMS) d Tone generator	Receiver of type 52A or equivalent telephone headset
J5	E&M DROP	Drop M lead	Line M lead (with TWD. L OFF HK/THRU/ON HK switch S5 at THRU) and TWD. D indicator DS4	All E&M operations	Line E lead (with TWD.D OFF HK/THRU/ON HK switch S4 at THRU) or E&M supervision and pulsing circuit (with TWD. L switch S5 at ON HK or OFF HK)	Drop E lead
J6	E&M LINE	Line E lead	Drop E lead (with TWD.D OFF HK/THRU/ON HK switch S4 at THRU) and TWD. L indicator DS3	All E&M operations	Drop M lead (with TWD. L OFF/HK/THRU/ON HK switch S5 at THRU) or E&M supervision and pulsing circuit (with TWD. D switch S4 at ON HK or OFF HK)	Line M lead
J7	TMS S/R 2W S4W (SEND/RECEIVE TWO-WIRE, SEND FOUR-WIRE; given as TMS SEND in text)	TMS instrument	J11 or J10 (SEND) and J3/J4 (MON)	Transmission loss and gain-slope tests, especially as implemented with TMS sets having send and receive capabilities	J11 (receiving two-wire)	TMS instrument
J8	TMS REC 4W	Not applicable	Not applicable	Transmission loss and gain-slope tests, especially as implemented with TMS sets having send and receive capabilities	J12 or J9 (REC)	TMS instrument
J9	DROP REC 4W	Drop four-wire VF circuit	a. J11 (SEND) and J3/J4 (MON) b. 600-ohm termination c. 600-ohm termination and J3/J4 (MON) d. J3/J4 (MONITOR) e. J8 (MEASURE) and J3/J4 (MON)	a. Through-connected, monitored circuit under test b. Any operation toward the line c. Sending in-band supervisory or address signals d. Sending external oscillator signal or communicating e. Transmission loss and gain-slope test (receiving TMS signals)	Not applicable	Not applicable

Table 4—1. (Cont'd).

REF DES	NOMENCLATURE	INCOMING		TEST SET APPLICATION(S)	OUTGOING	
		EXTERNAL SOURCE	SWITCHED TO		SWITCHED FROM	EXTERNAL DESTINATION
J10	DROP SEND 4W	Not applicable	Not applicable	a. Through-connected circuit under test b. Any operation toward the line c. Sending in-band supervisory or address signals d. Talking on four-wire drop circuit under test e. Transmission loss and gain-slope tests (sending oscillator signal) f. Transmission loss and gain-slope tests (sending TMS signal)	a. J12 (REC) b. 600-ohm termination c. Tone generator (SF, TT, MF) d. J3/J4 (TRANSMITTER) e. J2 (OSC) f. J7 (TMS)	Drop four-wire VF circuit
J11 On 2W	LINE S/R 2W S4W (SEND/ RECEIVE TWO-WIRE, SEND FOUR-WIRE, given as LINE SEND in text)	Line two-wire VF circuit	a. J9 (REC) and J3/J4 (MON) b. J7 (TMS) and J3/J4 (MON) c. J3/J4 (MON)	a. Through-connected, monitored two-wire circuit under test b. Transmission loss and gain-slope tests c. Communication on two-wire circuit d. Transmission loss and gain-slope tests (sending oscillator signal) e. Sending supervisory and address signals	a. J7 (TMS) b. J3/J4 (MON) c. J2 (OSC) d. Supervisory circuit and dial pulse generator	Line two-wire VF circuit
J11	Not applicable	Not applicable	Not applicable	a. Through-connected four-wire circuit under test b. Any operation toward the drop c. Sending in-band supervisory or address signals d. Talking on four-wire line circuit under test e. Transmission loss and gain-slope tests (sending TMS signal) f. Transmission loss and gain-slope tests (sending oscillator signal)	a. J9 (REC) b. 600-ohm termination c. Tone generator (SF, TT, MF) d. J3/J4 (MON) e. J7 (TMS) f. J2 (OSC)	Line four-wire VF circuit
J12	LINE REC 4W (Jack includes switch that inserts 16 dB-pad when plug inserted and 1S3 in LINE position)	Line four-wire VF circuit	a. J10 (SEND) and J3/J4 (MON) b. 600-ohm termination c. 600-ohm termination and J3/J4 (MON) d. J3/J4 (MON) e. J8 (TMS) and J3/J4 (MON)	a. Through-connected, monitored circuit under test b. Any operation toward the drop c. Sending in-band supervisory or address signals d. Sending external oscillator signal or communicating e. Transmission loss and gain-slope tests (receiving TMS signal)	Not applicable	Not applicable

Table 4—2. Model TTS 59C Front Panel Lever Switches.

REF DES	NOMENCLATURE	POSITION	INFLUENCE ON LINE OR DROP SIGNALS		ASSOCIATED SWITCHING REQUIREMENTS	APPLICATION
			FROM CIRCUIT UNDER TEST TO TEST SET	FROM TEST SET TO CIRCUIT UNDER TEST		
1S2	TMS/THRU/SND/OSC	TMS	Connects LINE REC 4W jack J12 or DROP REC 4W jack J9 to TMS REC 4W jack J8; connects LINE S/R 2W S4W jack J11 to TMS S/R 2W S4W jack J7.	Connects TMS S/R 2W S4W jack J7 to DROP SEND 4W jack J10 or LINE S/R 2W S4W jack J11.	Select LINE or DROP (1S3); select KP (1S3) to monitor outgoing TMS tone and select REC jack (J9 or J12).	Two- and four-wire transmission loss and gain-slope tests.
		THRU	Permits termination of selected REC jack (J9 or J12) while sending in-band supervisory and address signals.	Permits connection of transmitter, dial or in-band signaling to SEND jack J11 or J10.	Select LINE or DROP (1S3).	See 1S8.
		SEND OSC	None.	Connects OSC IN +7 dB jack J2 to selected SEND jack (J11 or J10).	Select LINE or DROP (1S3); select KP (1S3) to monitor outgoing tone and selected REC jack (J12 or J9).	Transmission loss and gain-slope tests.
1S3	DROP/THRU/LINE	LINE	Connects LINE REC 4W jack J12 to monitor and measurement circuits (four-wire tests); connects LINE S/R 2W, S4W to monitor and measurement circuits (two-wire tests). Terminates J9 (600 ohms).	Connects external circuit (such as TMS) to monitor and LINE S/R 2W S4W jack J11; inserts 7-dB pad into send path (except during two-wire dial pulsing); allows insertion of 16-dB pad (23 dB total) during four-wire line tests. See J12. Terminates J10 (600 ohms).	Select KP (1S8); to monitor non-talk signal.	VF operations toward the line.
		THRU	Connects LINE REC 4W jack J12 to DROP SEND 4W jack J10 and monitor; connects DROP REC 4W jack J9 to LINE S/R 2W S4W jack J11 and monitor.	See column 4; external circuit disconnected.	Select KP (1S8) to monitor REC jacks (J12 and J9).	Pass uniterrupted circuit through test set.
		DROP	Connects DROP REC 4W jack J9 to monitor and measurement circuits; terminates J12 (600 ohms).	Connects external circuit (such as TMS) to monitor and DROP SEND 4W jack J10.	Select KP (1S8) to monitor non-talk signal.	VF operation toward the drop.
1S4	TWD. D ON HK/THRU/ OFF HK	ON HK	None.	Sends on-hook to drop on E lead jack J5.	None.	E&M operations toward the drop.
		THRU	Connects line E lead jack J6 to drop E lead jack J5.	See column 4.	1S6 must be in CENTER position.	E&M operations toward the line; pass uninterrupted circuit under test E lead through test set.
		OFF HK	None.	Sends off-hook or address signals toward the drop on E lead jack J5.	Select DIAL D (1S6) to address.	E&M operations toward the drop.
1S5	TWD. L ON HK/THRU/ OFF HK	ON HK	None.	Sends on-hook to line on M lead jack J6	None	E&M operations toward the line.
		THRU	Connects drop M lead jack J5 to line M lead jack J6.	See column 4.	1S6 must be in CENTER position.	E&M operations toward the drop; pass uninterrupted circuit under test M lead through test set.
		OFF HK	None.	Sends off-hook or address signals toward the line on M lead jack J6.	Select DIAL L (1S6) to address.	E&M operations toward the line.

Table 4—2. (Cont'd).

REF DES	NOMENCLATURE	POSITION	INFLUENCE ON LINE OR DROP SIGNALS		ASSSOCIATED SWITCHING REQUIREMENTS	APPLICATION
			FROM CIRCUIT UNDER TEST TO TEST	FROM TEST SET TO CIRCUIT UNDER TEST		
1S6	DIAL D/CENTER/DIAL L	DIAL L	None.	Connects dial pulses to line M lead jack J6 through 1S6.	Select TWD. L OFF HK (1S5).	E&M operations toward the line.
		CENTER	None.	Disables E&M signaling.	None.	Through-connected circuit under test E&M circuit.
		DIAL D	None.	Connects dial pulses to drop E lead jack J5 through 1S4.	Select TWD. D OFF HK (1S4).	E&M operations toward the drop.
1S7	LOOP ON HK 2W/OFF HK 2W	ON HK 2W	None.	Sets two-wire on-hook condition.	Select DIAL + TALK 2W (1S8).	Beginning and final condition for line two-wire operations.
		OFF HK 2W	Connects LINE S/R 2W S4W jack J11 to T-R REV (WINK) indicator (DS2).	Sends "off-hook" to LINE S/R 2W S4W (J11, connects dial pulses.	Select LINE (1S3) and DIAL + TALK 2W (1S8).	Signaling two-wire line circuit.
1S8	DIAL + TALK 2W/KEY PULSE/TALK 4W	DIAL + TALK 2W	Connects LINE S/R 2W S4W jack J11 to monitor.	Connects transmitter to LINE S/R 2W S4W jack J11 and monitor.	Select THRU (1S2) and LINE (1S3).	Communicate on two-wire circuit
		KEY PULSE (KP)	Enables monitor channels A and B; see Table 4—5.	Connects in-band supervisory and address signals to LINE S/R 2W S4W (J11) or DROP SEND 4W (J10).	Select THRU (1S2) and LINE or Drop (1S5).	Sending in-band supervisory and address signals.
		TALK 4W	Connects LINE REC 4W jack J12 or DROP REC 4W jack J9 to monitor.	Connects transmitter to LINE S/R 2W S4W jack J11 or DROP SEND 4W jack J10.	Select THRU (1S2) and LINE or DROP (1S3).	Communicate on four-wire circuit.

Table 4—3. Model TTS 59C Addressing Controls.

REF DES	NOMEN-CLATURE	PURPOSE	APPLICATION(S)	ASSOCIATED SWITCHING REQUIREMENTS
A2S1	DP	When latched, enables 10-pps dial pulse generator.	a. Loop dial pulsing b. E&M pulsing. c. SF signaling	a. Select loop OFF HK 2W; use key-pad numerals b. Select DIAL L (or D) and set E&M L (or D) at OFF HK; use keypad numerals c. Select KP (not TALK; 1S8), set 1S2 at THRU; see A2S4
A2S2	TT	Enables standard Touch-Tone® signaling, latching.	TT address and TT information functions.	Select KP (not TALK; 1S8), set 1S2 at THRU; use keypad numerals
A2S3	MF	When latched, enables standard two-of-five multi-frequency signaling.	MF addressing.	Select KP (not TALK; 1S8), set 1S2 at THRU; use keypad numerals.
A2S4	SF	When latched, enables single frequency signal in conjuction with 2400 and 2600.	a. SF on-hook supervision. b. SF signaling.	a. Latch 2400 or 2600; select KP (not TALK; 1S8), set 1S2 at THRU b. Latch 2400 or 2600, latch DIAL; see also entry c under A2S1.
A2S5	2400	When latched, selects 2400 Hz for SF tone.	SF supervisory and address signals.	Latch SF; see also A2S4.
A2S6	2600	When latched, selects 2600 Hz for SF tone.	SF supervisory and address signals.	Latch SF; see also A2S4
None	0-9	Numeral buttons	All addressing modes	Latch DIAL, TT or MF
None	* KP	Keypulse...prepares receiving circuit for digits.	Precedes dialing digits in MF signaling.	None
None	# ST	Start pulse...indicates all digits have been sent.	Follows dialing digits in MF signaling.	None.
None	STP, ST2P, ST3P	TSPS and other functions.	MF information.	None.
None	REDIAL	Causes last-entered DP or SF address to be retrans-mitted once each time button is pressed when dial pulsing or SF signaling. An on-hook signal must be applied before redialing.	See A2S1	See A2S1, but numerals are not to be re-struck. Signal 'on-hook' before press-ing REDIAL.

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Table 4—4. Model TTS 59C VF Switching Summary.

ITEM	APPLICATION	DROP/ THRU/ LINE (1S3)	TMS/ THRU/ SND OSC (1S2)	DIAL + TALK 2W/ KEY PULSE/ TALK 4W (1S8)	LINE REC 4W (J12) FEEDS:	DROP REC 4W (J4) FEEDS:	TMS S/R 2W S4W (J7) FEEDS (GETS):	OSC IN (J2) FEEDS:	TRANSMITTER (J3/J4) FEEDS:	MON (J3/J4)			LINE S/R 2W S4W (J11) GETS (FEEDS):	DROP SEND (J10) GETS (FEEDS):	TMS REC 4W (J8) GETS:	REFERENCES	
										KP CHAN A	KP CHAN B	TALK DP'S				FIGURE(S)	PARA-GRAPH(S)
1	DIAL and talk two-wire toward LINE	LINE	THRU	DIAL + TALK 2W	–	–	–	–	LINE S/R 2W S4W & Monitor	–	–	LINE S/R 2W S4W & TRANSMITTER	Transmitter, (Monitor)	Term	–	4–8	4.43
2	TALK four-wire toward LINE	LINE	THRU	TALK 4W	Monitor	Term	–	–	LINE S/R 2W S4W	-	–	LINE REC 4W	Transmitter	Term	–	4–25	Various
3	TALK four-wire toward DROP	DROP	THRU	TALK 4W	Term	Monitor	–	–	DROP SEND 4W	-	–	DROP REC 4W	Term	Transmitter	–	4–26	Various
4	SEND in-band supervisory or address signals toward DROP (2W)	LINE	THRU	KEY PULSE	–	–	–	–	–	LINE S/R 2W S4W & SF, MF, or TT	–	–	SF, MF, TT (Monitor)	Term		4–11, 4–13, 4–15	4.47, 4.49, 4.51
5	SEND in-band supervisory or address signals toward LINE (4W)	LINE	THRU	KEY PULSE	Term & Monitor	Term	–	–	–	SF, MF, or TT	LINE REC 4W	–	SF, MF, TT	Term	–	4–21, 4–23, 4–10	4.61, 4.63
6	SEND in-band supervisory or address signals toward DROP (2W)	DROP	THRU	KEY PULSE	–	–	–	–	–	–	DROP SEND 4W & SF, MF, or TT	–	Term	SF, MF, TT (Monitor)	–	4–12, 4–14, 4–16	4.45, 4.47, 4.49, 4.51
7	SEND in-band supervisory or address signals toward DROP (4W)	DROP	THRU	KEY PULSE	Term	Term & Monitor	–	–	–	DROP REC 4W	SF, MF, or TT	–	Term	SF, MF, TT	–	4–22, 4–24	4.61, 4.63
8	TMS operations toward the LINE (2W)	LINE	TMS	KEY PULSE	–	–	LINE S/R 2W S4W & Monitor (LINE S/R 2W S4W)	–	–	TMS S/R 2W S4W & LINE S/R 2W, S4W	–	–	TMS S/R 2W S4W (TMS S/R 2W S4W & Monitor)	Term	–	4–19	4.55
9	TMS operation toward the LINE (4W)	LINE	TMS	KEY PULSE	TMS REC 4W & Monitor	Term	LINE S/R 2W S4W & Monitor	–	–	TMS S/R 2W S4W	LINE REC 4W	-	TMS S/R 2W S4W	Term	LINE REC 4W	4–27	4.67
10	TMS operations toward the DROP (2W)	DROP	TMS	KEY PULSE	–	–	DROP SEND 4W & Monitor (DROP SEND 4W)	–	–	–	DROP SEND 4W & TMS S/R 2W S4W	–	Term	TMS S/R 2W S4W (TMS S/R 2W S4W & Monitor)	–	4–20	4.55
11	TMS operations toward the DROP (4W)	DROP	TMS	KEY PULSE	Term	TMS REC 4W & Monitor	DROP SEND 4W & Monitor	–	–	DROP REC 4W	TMS S/R 2W, S4W	–	Term	TMS S/R 2W S4W	DROP REC 4W	4–28	4.67
12	EXT oscillator toward the LINE (2W)	LINE	OSC SEND	KEY PULSE	–	–	–	LINE S/R 2W S4W & Monitor	–	OSC IN & LINE S/R 2W, S4W	–	–	OSC IN (Monitor)	Term	–	4–19	4.58
13	EXT oscillator toward the LINE (4W)	LINE	OSC SEND	KEY PULSE	Monitor	Term	–	LINE S/R 2W S4W & Monitor	–	OSC IN	LINE REC 4W	–	OSC IN	Term	–	4–27	4.69
14	EXT oscillator toward the DROP (2W)	DROP	OSC SEND	KEY PULSE	–	–	–	DROP SEND 4W & Monitor	–	–	OSC IN & DROP SEND 4W		Term	OSC IN (Monitor)	–	4–20	4.58
15	EXT oscillator toward the DROP (4W)	DROP	OSC SEND	KEY PULSE	Term	Monitor	–	DROP SEND 4W & Monitor	–	DROP REC 4W	OSC IN	–	Term	OSC IN	–	4–28	4.69

Table 4—5. Model TTS 59C Front Panel Indicators.

REF DES	NOMENCLATURE	DESCRIPTION
DS1	POWER	When lighted, indicates that POWER switch is ON and power is applied to unit.
DS2	T-R REV (WINK)	Indicates tip/ring polarity status on loop circuits. Normally lighted when tip more negative than ring. But, internal programming can reverse this indication (see paragraph 4.13).
DS3	E&M TWD. L	Indicates idle/busy status of E lead on line side of E&M circuits. Normally lighted for open or battery condition on E lead to indicate idle circuit. But, internal programming can change this indication (see paragraph 4.20).
DS4	E&M TWD.D	Indicates idle/busy status of M lead on drop side of E&M circuits. Normally lighted for ground or open condition on M lead to indicate idle circuit. But, internal programming can change this indication (see paragraph 4.20).

4.4 GENERAL OPERATING CONSIDERATIONS.

4.5 Paragraphs 4.6 through 4.28 contain general operating information relative to all of the operating procedures.

4.6 POWER CONSIDERATIONS.

4.7 The Model TTS 59C operates from a central office battery supply within the range of 43 to 56 Vdc. The approximate current drawn by the unit is 500 milliamperes. The input power is connected via a 310-type jack wired to receive ground on the sleeve and −48 Vdc on the tip.

4.8 RELATED TMS TEST EQUIPMENT.

4.9 Transmission tests such as level, circuit noise and noise-to-ground can be conducted thru the TTS 59C by using an external TMS such as the Northeast Electronics Model TTS 44. The TMS is connected to a two-wire or four-wire circuit under test through the switching circuits of the TTS 59C. The TMS S/R 2W S4W jack accepts TMS outputs for connection to the TMS. The TMS REC jack delivers signals from a four-wire circuit to the TMS.

4.10 Various common telephone office test lines can be dialed up via the TTS 59C. Type 100, 102, and 103 test lines can be used when making signaling and addressing tests with the TTS 59C alone. Type 100, and 102 test lines can be dialed when making transmission test with an oscillator or TMS. Pads in the TTS 59C control the level inserted into the circuit under test via the OSC jack. Refer to Table 4—6.

Table 4—6. Model TTS 59C Output Levels.

OUTPUT TYPE	LEVEL		
	DROP SEND 4W	LINE S/R 2W S4W	
		4W	2W
MW (+7 dBm at J2)	+7 dBm	−16 dBm	0 dBm
MF	+1 dBm	−22 dBm	−6 dBm
TT	+1 dBm	−22 dBm	−6 dBm
SF (DIAL)	−1 dBm	−24 dBm	
SF (ON HK)	−13 dBm	−36 dBm	

4.11 TEST SET INTERNAL PROGRAMMING.

4.12 Paragraphs 4.13 through 4.20 provide the information required to program the unit's internal tip-ring reversal sensing function, the E&M send conditions, E&M receive threshold levels, and the E&M indicator options.

4.13 Internal Tip-Ring Reversal Programming.

4.14 The T-R REV (WINK) indicator can be wired to be lighted with normal or reversed input polarity. The

TTS 59C, as shipped from the factory is wired to produce a lighted indication when the tip of a two-wire circuit is negative with respect to the ring. Figure 4—2 shows the location of strapping terminals A, B, and C on the relay board. When A is strapped to B, the T-R REV indicator will be lighted when the tip is negative. When A is strapped to C, the indicator will be lighted when the tip is positive with respect to the ring.

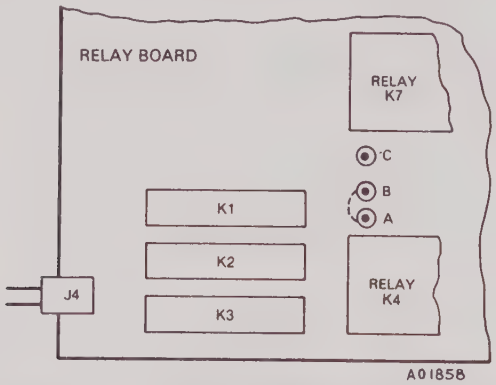


Figure 4—2. Tip-Ring Reversal Strap Location.

4.15 **Internal E&M Function Programming.**

4.16 The TTS 59C is capable of sending and monitoring many types of E&M signaling presently in use. A pair of multiple-section switches mounted on the E&M board programs each lead independently to accomodate the various types of E&M signaling.

4.17 Figure 4—3 shows the factory settings of the E-lead and M-lead switches. This figure also shows the function of each switch section. In addition, sending and monitoring conditions as factory set are described.

4.18 Figures 4—4 through 4—6 show three of the most common types of E&M signaling...several other E&M signaling types are also in use. The table in each of the figures can serve as a guide to program the internal E&M functions of the TTS 59C. The following defines the terms used in Figures 4—4 through 4—6.

1. Protected battery: —48V protected by a resistance lamp which the TTS 59C sends.

2. —48V Resistive: on-hook condition whose actual voltage level is facility dependent.

3. Negative Voltage: off-hook condition whose actual voltage level is facility dependent.

4. Unspecified: on-hook condition which is facility dependent...user must determine the condition and program the TTS 59C accordingly.

4.19 Programming the E&M functions consists of three parts for each lead.

1. Use switch section 1 through 4 to select the threshold level. The threshold level determines what negative voltage level is to be considered off-hook. Only one of the four switch sections should set at on.

2. Use switch section 5 and 6 to set the conditions which turn on the lead status indicator. Each indicator busy. Only **one** switch section **can** be on at a time.

3. Select the send conditions.

a. Switch sections 7 and 8 of switches S8 and S7 determine the on-hook state of the E-lead and M-lead respectively. Only one of the specified sections should be set at on.

b. Switch section 9 and 10 control the off-hook state...only one of these two specified sections should be set at on.

4.20 The E-lead and M-lead switches are located on the E&M board. The E&M board in turn is located between the front panel and the relay board. A slender tool such as a slim screwdriver may be used to manipulate the switches. **The switches should never be manipulated with power connected to the TTS 59C.** To expose the E-lead and M-lead for easy access:

1. Disconnect power from the 59C.

2. Remove the chassis from the case...four sets of screws and washers hold the chassis secured to the case.

3. Lift out the chassis.

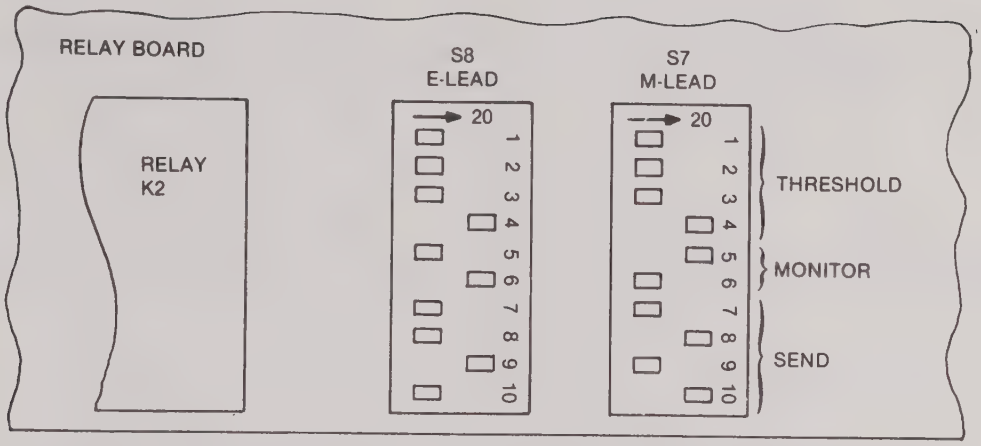
4. Disconnect the four cables connected to the relay board.

5. Loosen and remove the four screws and lock washers securing the relay board.

6. Lift and remove the relay to expose the E-lead and M-lead switches on the E&M board.

7. After resetting the switches as required, ensure that **at most only one** switch section is on for each function as follows:

a. threshold: section 1, 2, 3, or 4;
b. monitor: section 5 or 6;
c. send on hook: section 7, 8 or both off;
d. send off hook: section 9, 10, or both off.



THRESHOLD	SET SECTION			
	1	2	3	4
- 2 8V	ON			
- 4.8V		ON		
- 10 4V			ON	
- 12 8V				ON *

THRESHOLD	SET SECTION			
	1	2	3	4
- 3 3V	ON			
- 5 2V		ON		
- 10.6V			ON	
- 12 6V				ON *

INDICATION	CONDITION	SECTION	
		5	6
LIGHT IF IDLE	BATT OR OPEN	ON	
	GND		ON *
LIGHT IF BUSY	BATT OR OPEN		ON
	GND	ON	

INDICATION	CONDITION	SECTION	
		5	6
LIGHT IF IDLE	BATT	ON	*
	OPEN OR GND		ON
LIGHT IF BUSY	BATT		ON
	OPEN OR GND	ON	

STATE	SEND	SECTION	
		7	8
ON HOOK	OPEN		*
	GND		ON
	BATT	ON	
		SECTION	
		9	10
OFF HOOK	OPEN		
	GND	ON	*
	BATT		ON

STATE	SEND	SECTION	
		7	8
ON HOOK	OPEN		
	GND		ON *
	BATT	ON	
		SECTION	
		9	10
OFF HOOK	OPEN		
	GND	ON	
	BATT		ON *

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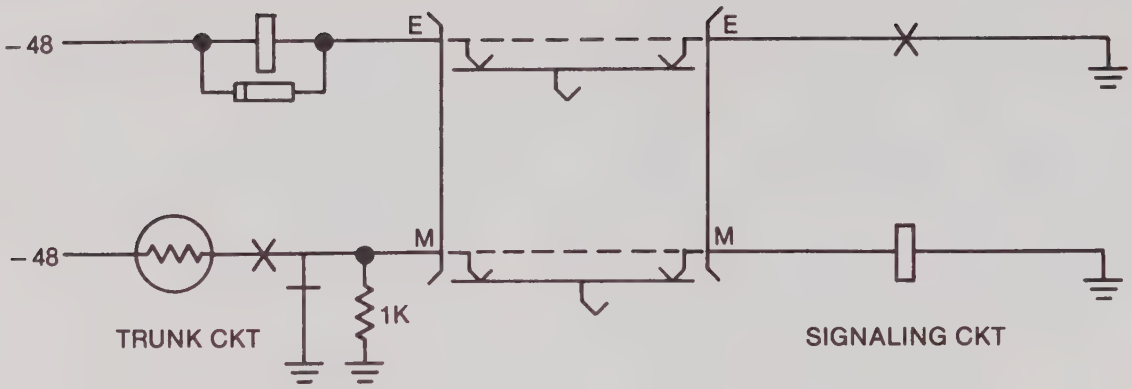
* = Factory Setting

Figure 4—3. Factory Setting of E&M Programming Switches.



LEAD	ON-HOOK (IDLE) CONDITION		OFF-HOOK (BUSY) CONDITION	
	MONITOR (BRIDGE)	SEND	MONITOR (BRIDGE)	SEND
M	Ground	Ground	Negative Voltage	Protected Battery
E	– 48V Resistive	Open	Ground	Ground

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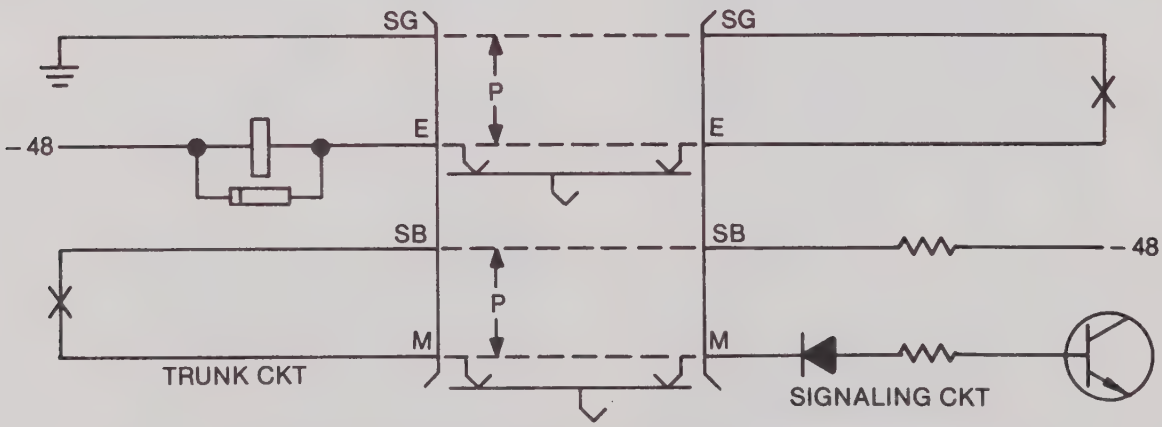
Figure 4—4. Type I E&M Circuit.



LEAD	ON-HOOK (IDLE) CONDITION		OFF-HOOK (BUSY) CONDITION	
	MONITOR (BRIDGE)	SEND	MONITOR (BRIDGE)	SEND
M	Unspecified	Open	Negative Voltage	Protected Battery
E	– 48V Resistive	Open	Ground	Ground

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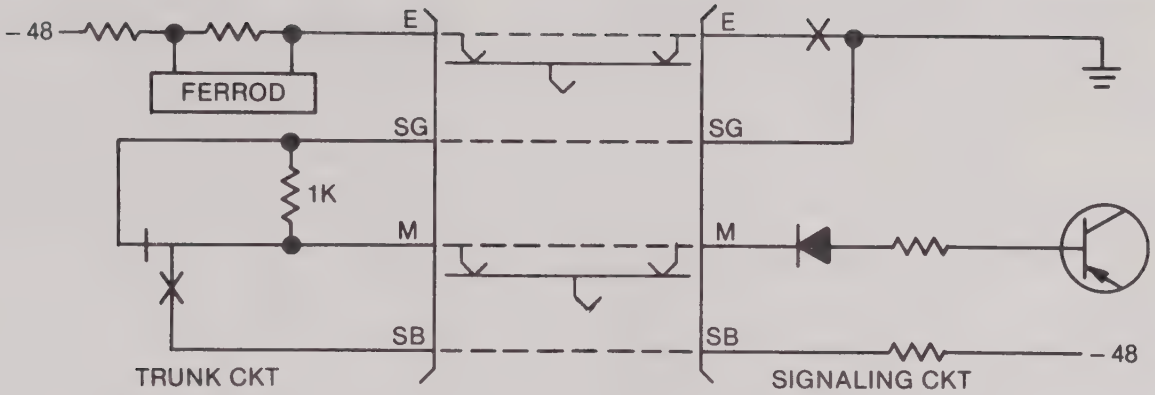
Figure 4—5. Type II E&M Circuit.



LEAD	ON-HOOK (IDLE) CONDITION		OFF-HOOK (BUSY) CONDITION	
	MONITOR (BRIDGE)	SEND	MONITOR (BRIDGE)	SEND
M	Ground	Ground	Negative Voltage	Protected Battery
E	– 48V Resistive	Open	Ground	Ground

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Figure 4–6. Type III E&M Circuit.

4.21 VF SWITCHING SUMMARY.

4.22 Table 4–4 summarizes voice-frequency switching in the TTS 59C. The table presents the major VF applications along with related switch positions and important circuit connections. The DROP/THRU/LINE switch, the TMS/THRU/SND OSC switch, and the DIAL + TALK 2W/KEY PULSE/TALK 4W switch controls the connection of inputs from J2, J3/J4, J7, J8, J11, and J12 and outputs J3/J4, J7, J8, J10, and J11. The terms "feeds" and "gets" in the jack columns relate to internal connections only. For example, J12 is connected through the unit to J10 to monitor four-wire VF signals from the line. The table will clarify many questions about the test set operation, especially those regarding the monitor function.

4.23 The terms CHAN A and CHAN B are nothing more than convenient definitions of internal functional connection points. The signals named under these heading are combined before connection to the external headset receiver. The prefix KP is a reminder that the DIAL + TALK 2W/KEY PULSE/TALK 4W switch must be in the KEY PULSE position to hear the designated tones. The signals under TALK OP'S are heard with this switch in either DIAL + TALK 2W or TALK 4W.

4.24 The table reveals general characteristics of the named switches and jacks as follows.

1. Completion of the headset transmitter and in-band tone signaling circuits requires that the TMS/THRU/SND OSC switch be in the THRU position.

2. The telephone headset transmitter is not enabled when the DIAL + TALK 2W/KEY PULSE/TALK 4W switch is in the KEY PULSE position.

3. In-band tone signaling is enabled only with the DIAL + TALK 2W/KEY PULSE/TALK 4W switch in the KEY PULSE position.

4. From 2 and 3 above, it is seen that the transmitter and in-band tone signals are not mixed.

5. The monitor is never disabled.

6. No signal generated internally or by auxiliary instruments such as a TMS or an oscillator can be connected to the line and drop circuits when the DROP/THRU/LINE switch is at THRU.

7. Quiet, blocked, 600-ohm terminations are connected to the LINE SEND and REC jacks when the DROP/THRU/LINE switch is at DROP and to DROP SEND and REC jacks with this switch at LINE.

The table obscures the fact that any operation which can be done toward the line can also be done toward the drop. Certain operations toward the drop are not expected to be used and are thus not described in the table.

4.25 OUTPUT LEVELS.

4.26 Table 4—6 lists the TTS 59C output levels into drop and line sides of circuits under test. The milliwatt signal is an output derived from an external oscillator connected to J2 or J7. Signals from such external units should be set at +7 dBm. Pads in the TTS 59C are switched to produce appropriate levels into drop and line directions on two-wire or four-wire circuits. The other output types (SF, MF, and TT) are generated within the TTS 59C. The 16-dB pad associated with sending toward the line on four-wire circuits is inserted only when the DROP/THRU/LINE switch is at LINE and a plug is inserted into the LINE REC 4W jack. This arrangement avoids inadvertent insertion of the pad in:

1. the line direction on two-wire circuits, and

2. any drop circuit.

4.27 GENERAL OPERATING SEQUENCE.

4.28 After selecting the appropriate patching scheme, the general procedure is much like operating a telephone set, but with provisions for using accessory instruments. These instruments can be used to insert known test levels into a circuit under test, as desired. Similar instruments located at the far end can be used to measure received levels. The general sequence illustrated in Figure 4—7 is as follows.

1. Prepare circuit under test, the TTS 59C, and any auxiliary test sets.

a. Patch 48-volt supply to TTS 59C and to auxiliary instruments.

b. Connect telephone set and auxiliary instruments to the TTS 59C if required.

c. Initialize TTS 59C controls.

d. Apply power to all units.

e. Patch circuit under test to the TTS 59C.

2. Test busy status of circuit under test.

3. Seize circuit by signaling off-hook to the far end.

4. When far end is ready, send address signaling as required.

5. When far end goes off-hook (answers), commence transmission or other testing as desired using auxiliary instruments.

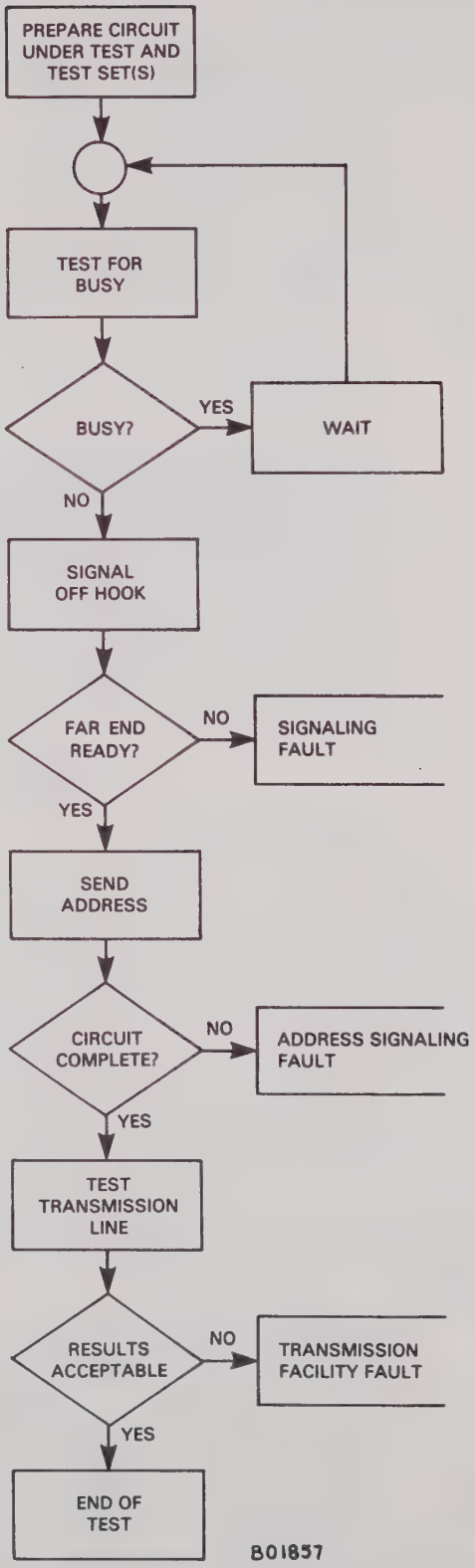

Figure 4—7. TTS 59C General Sequence of Operation.

4.29 **CONFIDENCE TESTS.**

4.30 Confidence in the operating condition of the unit is normally gained during routine operation by use of the VF monitor function. Table 4—4 shows that monitor inputs include in-band supervisory and address signaling tones, external oscillator signals, TMS test signals, and two-wire transmitter signals. Other test set functions can be checked using the procedures that follow.

4.31 FOUR-WIRE TALK CONFIDENCE TEST.

4.32 Connection of the headset transmitter to the LINE and DROP SEND jacks and connection of the LINE and DROP REC jacks to the monitor in four-wire talk operation is checked as follows.

1. Connect central office battery source to the 48V jack.

2. Connect a type 52A telephone headset to the TEL SET jacks.

3. Set POWER switch at ON.

4. Set DIAL + TALK 2W/KEY PULSE/TALK 4W switch at TALK 4W.

5. Set DROP/THRU/LINE switch at DROP.

6. Set all other lever switches at their center position.

7. Patch DROP SEND jack to DROP REC jack.

8. Voice should be heard in the headset when speaking into the transmitter.

9. Remove patch from DROP SEND-DROP REC jacks.

10. Patch LINE REC jack to LINE SEND jack.

11. Set DROP/THRU/LINE switch at LINE.

12. Voice should be heard in the headset when speaking into the transmitter. The level will be lower than that heard from the drop circuit.

4.33 E&M CONFIDENCE TESTS.

4.34 The E&M Functions are tested as follows.

NOTE

This test applies only when the E&M sending function uses protected battery.

1. Connect central office battery source to the 48V jack.

2. Set POWER switch at on.

3. Set both E&M switches at ON HK.

4. Set all other lever switches at their center position.

5. Patch E&M LINE jack to E&M DROP jack.

6. If the unit is programmed for lighted E&M indicators during the idle state, both E&M indicators should be lighted. (Both indicators will be off if the unit is internally programmed for dark indicators during the idle state. See paragraph 4.20.)

7. Set both E&Mswitches at OFF HK.

8. The E&M indicators should change state from that observed in step 6.

9. Set DIAL L/CENTER/DIAL D switch at DIAL L.

10. Latch DP pushbutton.

11. Press any keypad numeral. The E&M TWD.D indicator should flash.

12. Set DIAL L/CENTER/DIAL D switch at DIAL D.

13. Set both E&M switches at THRU, then return to OFF HK.

14. Press REDIAL pushbutton. The E&M TWD. L indicator should flash.

4.35 AUXILIARY INSTRUMENT AND PAD CONFIDENCE TESTS.

4.36 The internal connections and pads can be tested as follows.

1. Connect central office battery source.

2. Set POWER switch at ON.

3. Set DROP/THRU/LINE switch at DROP.

4. Set TMS/THRU/SEND OSC switch at TMS

5. Connect the send section of a TMS instrument to the TMS SEND jack.

6. Adjust the send section of the TMS instrument to +7.0±0.1 dBm at 1 kHz.

7. Patch the DROP SEND jack to the DROP REC jack.

8. Measure the level present at the TMS REC jack with the receive section of the TMS instrument. It should be $+7.0 \pm 0.5$ dBm.

9. Latch the SF pushbutton.

10. Measure the level present at the TMS REC jack with the receive section of the TMS instrument. It should still be $+7.0 \pm 0.5$ dBm.

11. Release the SF pushbutton.

12. Set the DROP/THRU/LINE switch at LINE.

13. Transfer the patch to the LINE SEND and REC jacks.

14. Measure the level present at the TMS REC jack with the receive section of the TMS instrument. It should still be $+7.0 \pm 0.5$ dBm.

15. Remove the patch from the LINE SEND and REC jacks.

16. Set DROP/THRU/LINE switch at DROP.

17. Set TMS/THRU/SND OSC switch at SND OSC.

18. Connect the send section of the TMS instrument to OSC IN jack.

19. Measure the level present at the DROP SEND 4W jack with the receive section of the TMS instrument. It should be $+7.0 \pm 0.5$ dBm.

20. Latch the SF pushbutton.

21. Measure the level present at the DROP SEND 4W jack with the receive section of the TMS instrument. It should be -5 ± 0.1 dBm (approximately 12 dB drop).

22. Release the SF pushbutton.

23. Set DROP/THRU/LINE switch at LINE.

24. Measure the level present at the LINE SEND jack with the receive section of the TMS instrument. It should be 0 ± 1 dBm (approximately 7 dB drop).

25. Insert one end of a patch cord in LINE REC jack.

26. Measure the level present at the LINE SEND jack with the receive section of the TMS instrument. It should be -16 ± 1 dBm (approximately 23 dB drop).

4.37 OPERATING PROCEDURES.

4.38 Paragraphs 4.41 through 4.68 contain detailed operating procedures. Paragraph 4.39 is particularly important in that adherence to this sequence simplifies test set operation and helps avoid operating errors. All of the test procedures are illustrated. Each illustration shows the connection of the test set to the circuit under test, the basic signal flow within the set, and applicable controls. The tip and ring connections are not shown separately but are represented by a single flow line. Lines between controls and blocks show major control functions. Heavy accenting lines around button-type controls serve to identify those controls applicable to the test illustrated. Heavy dashed lines indicate controls used following a step involving those with heavy solid lines. The procedures for supervision and address signaling link to other procedures involving auxiliary instruments, which are not affected by the mode of supervision and address signaling.

4.39 Select the procedure (or procedures) required to execute the desired test (one supervision and address procedure and, if necessary, one procedure for using auxiliary instrumentation). First, connect power. Then, connect telephone headset and auxiliary instruments if required. Energize auxiliary instruments. Make initial switch settings. Energize test set. Connect test set to circuit under test via patch bay. These preparatory steps are detailed in each supervisory and address procedure. No preparatory actions are required between linking procedures.

4.40 If a test is interrupted, any 4-wire circuit under test can be patched through without disconnecting any patch cord by setting the DROP/THRU/LINE switch at THRU, the E&M TWD. L and TWD. L switches at THRU, and the DIAL L/CENTER/DIAL D switch at its center position. No 2-wire through connection is provided between S/R 2W S4W LINE jack and SEND 4W DROP jack.

4.41 TWO-WIRE CIRCUIT SUPERVISION AND ADDRESS SIGNALING PROCEDURE.

4.42 Paragraphs 4.43 through 4.54 provide instructions to supervise, dial, and talk on two-wire circuits.

NOTE

Observe that 2-wire MF and TT levels are -6 dBm at the LINE jack and $+1$ dBm at the DROP jack. Two-wire SF level is -20 dBm at the LINE jack and -8 dBm at the DROP jack.

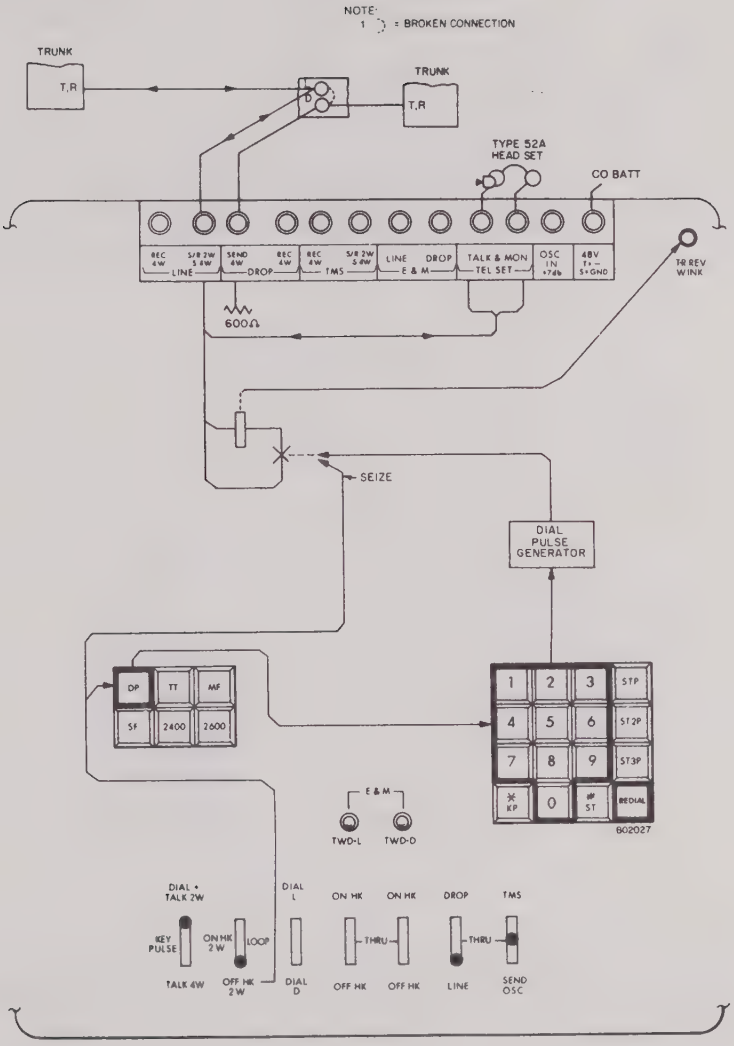

Figure 4—8. Supervise, Dial Pulse, and Talk on Loop Toward Line.

4.43 **Supervise, Dial Pulse, and Talk on Loop Circuits.**

4.44 Supervising, dialing, and talking on a loop toward the line is illustrated in Figure 4—8. (The talk function is summarized as item 1 in Table 4—4). Figure 4—9 shows the same operating sequence toward the drop, which is the same except for the setting of the DROP/THRU/LINE switch and patching of the DROP SEND jack. To supervise, dial pulse and talk on loop circuits, perform the following steps.

1. Connect central office battery source to the 48V jack.

2. Connect auxiliary instrument to the test set and energize the auxiliary instruments if required.

3. Connect a type 52A telephone headset to the TEL SET jacks if required.

4. Release all pushbuttons in the six-button array.

5. Set all lever switches at their center position.

6. Set DIAL + TALK 2W/KEY PULSE/TALK 4W switch at DIAL + TALK 2W.

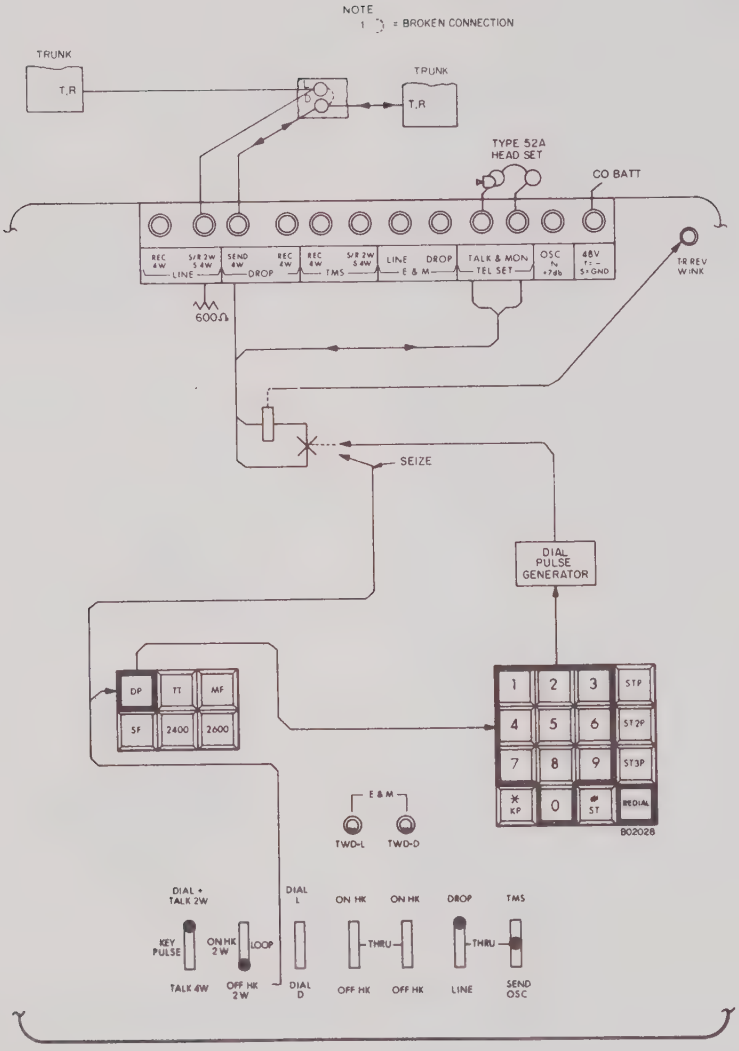

Figure 4—9. Supervise, Dial Pulse, and Talk on Loop Toward Drop.

7. Set DROP/THRU/LINE switch at LINE or DROP as required.

8. Set POWER switch at ON.

9. Connect the test set to the patch bay as shown in either Figure 4—8 or Figure 4—9 as required.

10. Set LOOP ON HK 2W/OFF HK 2W switch at OFF HK 2W.

11. Wait for T-R REV (WINK) indication if necessary.

12. Latch DP pushbutton.

13. Use keypad to send dial pulses on the loop.

14. To use the redial feature, first momentarily set LOOP OH HK 2W/OFF HK 2W switch at ON HK 2W and return to OFF HK 2W. Then press REDIAL push-button.

15. The circuit is ready for communication when the called number answers.

16. See paragraphs 4.55 and 4.57 for other operations possible at this point in the test.

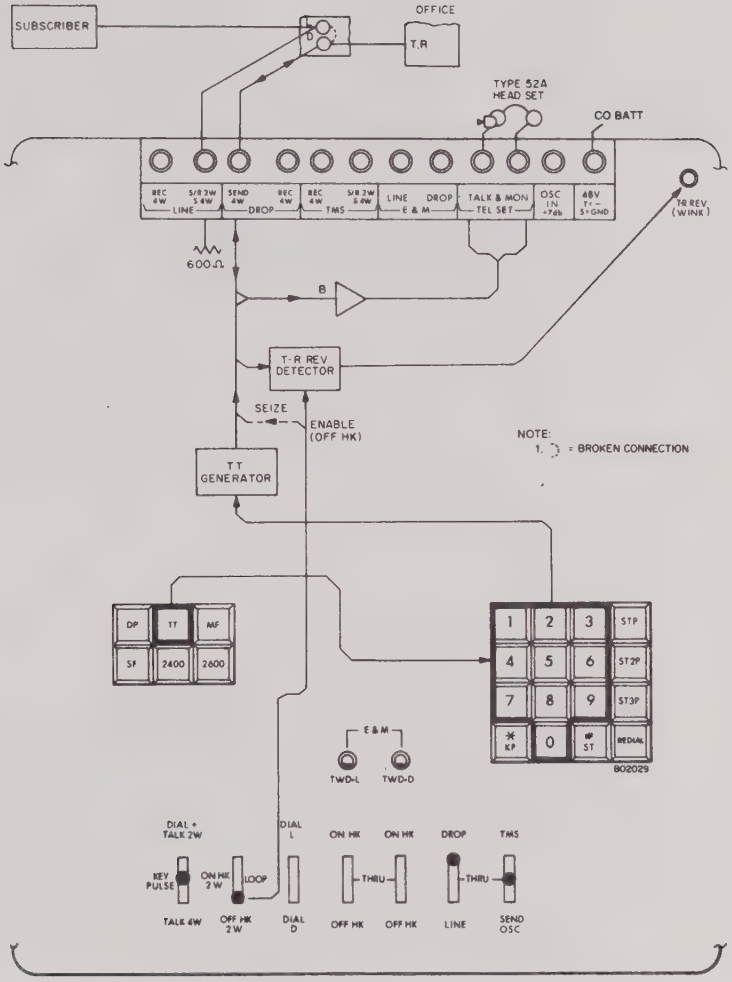

Figure 4—10. Supervision on Loop Toward Drop With TT Signaling.

4.45 **Supervision on Loop Circuit Toward the Drop with TT Signaling.**

4.46 Supervising on a loop circuit toward the drop and use of TT signaling is shown on Figure 4—10 and outlined in the following steps. (In-band tone signaling on a loop toward the drop is summarized as item 6 in Table 4—4.)

1. Connect central office battery source to the 48V jack.

2. Connect auxiliary instrument to the test set and energize the auxiliary instrument if required.

3. Connect a type 52A telephone headset to the TEL SET jacks if required.

4. Release all pushbuttons in the six-button array.

5. Set all lever switches at their center position.

6. Set DROP/THRU/LINE switch at DROP.

7. Connect the unit to the patch bay as shown on Figure 4—10.

8. Set POWER switch at ON.

9. Set LOOP OH HK 2W/OFF HK 2W switch at OFF HK 2W.

10. Wait for T-R REV (WINK) indication if necessary.

11. Latch TT pushbutton.

12. Use the keypad to send Touch Tone signals on the loop.

13. Communications can be established by setting the DIAL + TALK 2W/KEY PULSE/TALK 4W switch at DIAL + TALK 2W.

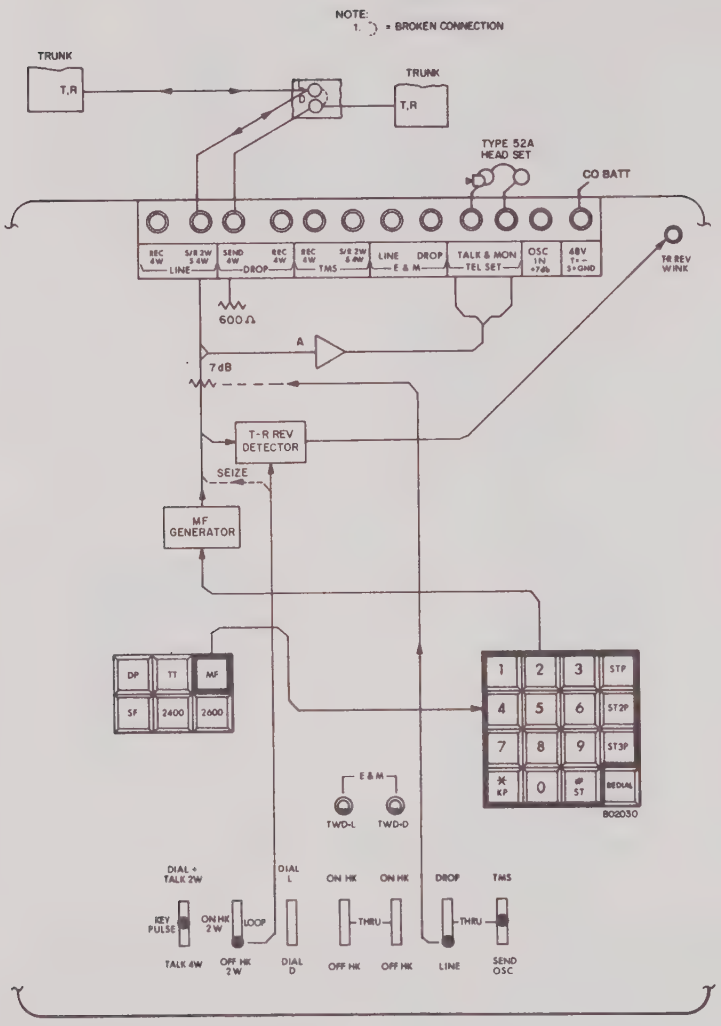

Figure 4—11. Supervision on Loop Toward Line With MF Signaling.

4.47 **Supervision on Loop Circuit Using MF Signaling.**

4.48 The supervisory operations on a loop circuit using MF signaling toward the line are shown on Figure 4—11, toward the drop on Figure 4—12, and presented in the following steps. (In-band tone signaling on a loop circuit is summarized as items 4 and 6 in Table 4—4.)

1. Connect central office battery source to the 48V jack.

2. Connect auxiliary instrments to the test set and energize auxiliary instruments if required.

3. Connect a type 52A telephone headset to the TEL SET jacks if required.

4. Release all pushbuttons in the six-button array.

5. Set all lever switches at their center position.

6. Set DROP/THRU/LINE switch at LINE or DROP as required.

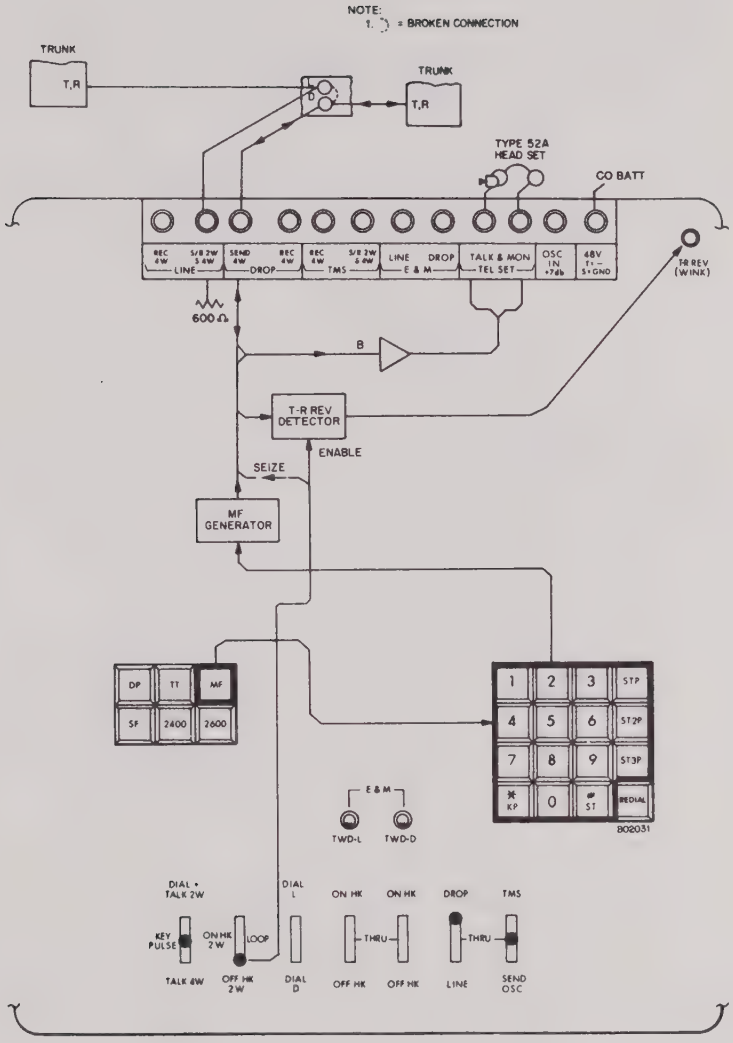

Figure 4—12. Supervision on Loop Toward Drop With MF Signaling.

7. Connect test set to the patch bay as shown in Figure 4—11 or 4—12 as required.

8. Set POWER switch at ON.

9. Set LOOP ON HK 2W/OFF HK 2W switch at OFF HK 2W.

10. Latch MF pushbutton.

12. Use the keypad to send MF tones on the loop.

13. Communications can be established by setting the DIAL + TALK 2W/KEY PULSE/TALK 4W switch at DIAL + TALK 2W.

14. See paragraphs 4.55 and 4.57 for other operations that can be performed at this point in the procedure.

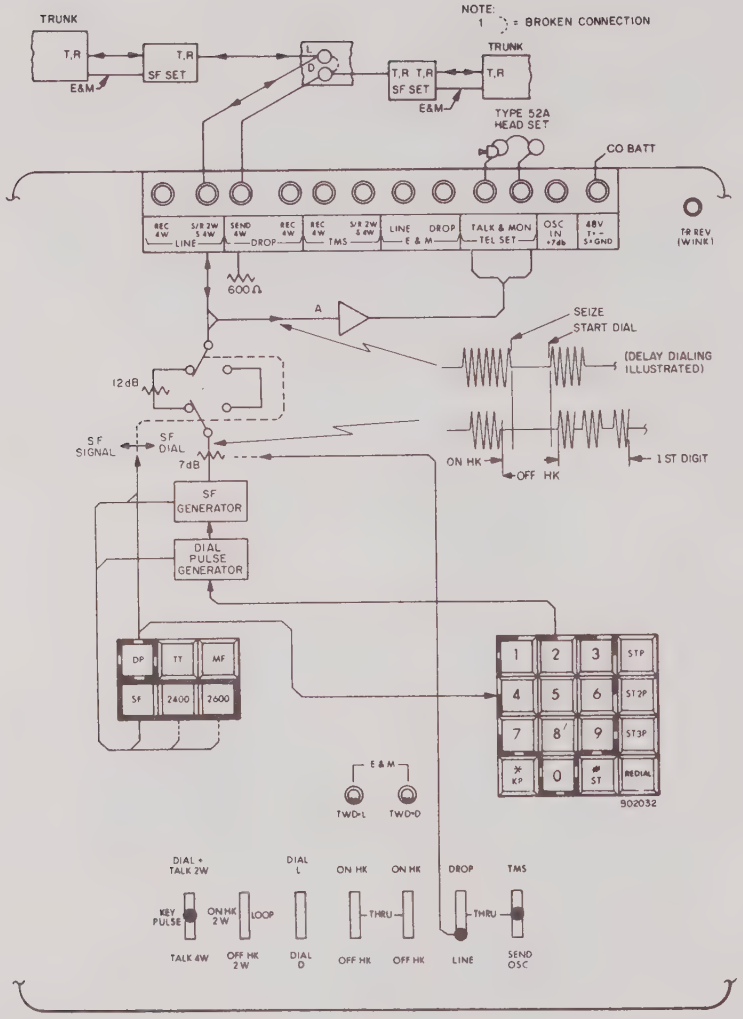

Figure 4—13. SF Supervision and Address Signaling on Two-Wire Circuit Toward Line.

4.49 **SF Supervision and Address Signaling on a Two-Wire Circuit.**

4.50 Two-wire circuit SF supervision and address signaling operations are shown on Figures 4—13 and 4—14 and presented in the following steps. Figure 4—13 shows the operation toward the line and Figure 4—14 toward the drop. (In-band tone signaling on a two-wire circuit is summarized as items 4 and 6 in Table 4—4.)

1. Connect central office battery source to the 48V jack.

2. Connect auxiliary instrument to the test set and energize auxiliary instrument if required.

3. Connect a type 52A telephone headset to the TEL SET jacks if required.

4. Release all pushbuttons in the six-button array.

5. Set all lever switches at their center position.

6. Latch the SF pushbutton.

7. Latch either the 2600 or 2400 pushhbutton as required.

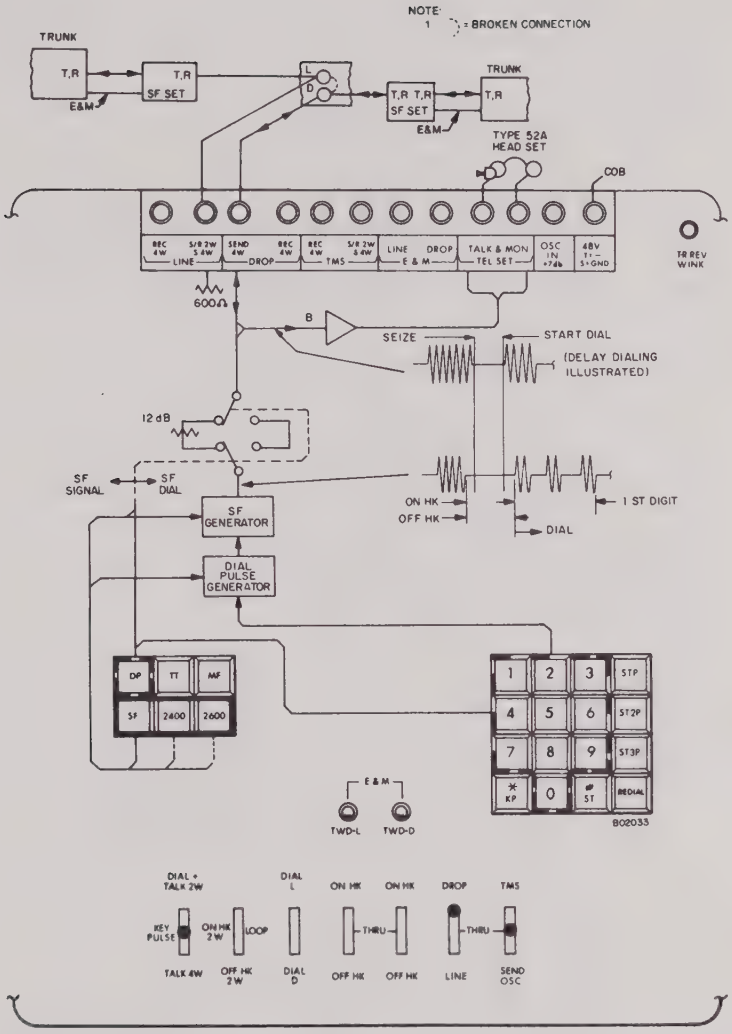

Figure 4—14. SF Supervision and Address Signaling on Two-Wire Circuit Toward Drop.

8. Set DROP/THRU/LINE switch at LINE or DROP as required.

9. Set POWER switch at ON.

10. Connect the unit to the patch bay as shown on Figures 4—13 or 4—14 as required.

11. Signal off-hook by latching the DP pushbutton.

12. Wait for a VF indication that the far end is ready to accept signals.

13. Send SF tone bursts on the circuit by pressing the numeral pushbuttons on the keypad.

14. To use the redial feature, release and relatch the DP pushbutton (This action applies a momentary on-hook signal.) Then press the REDIAL pushbutton.

15. Communication of the circuit can be established by setting DIAL + TALK 2W/KEY PULSE/TALK 4W switch at DIAL + TALK 2W.

16. See paragraphs 4.55 and 4.57 for other operations that are possible at this point in the test.

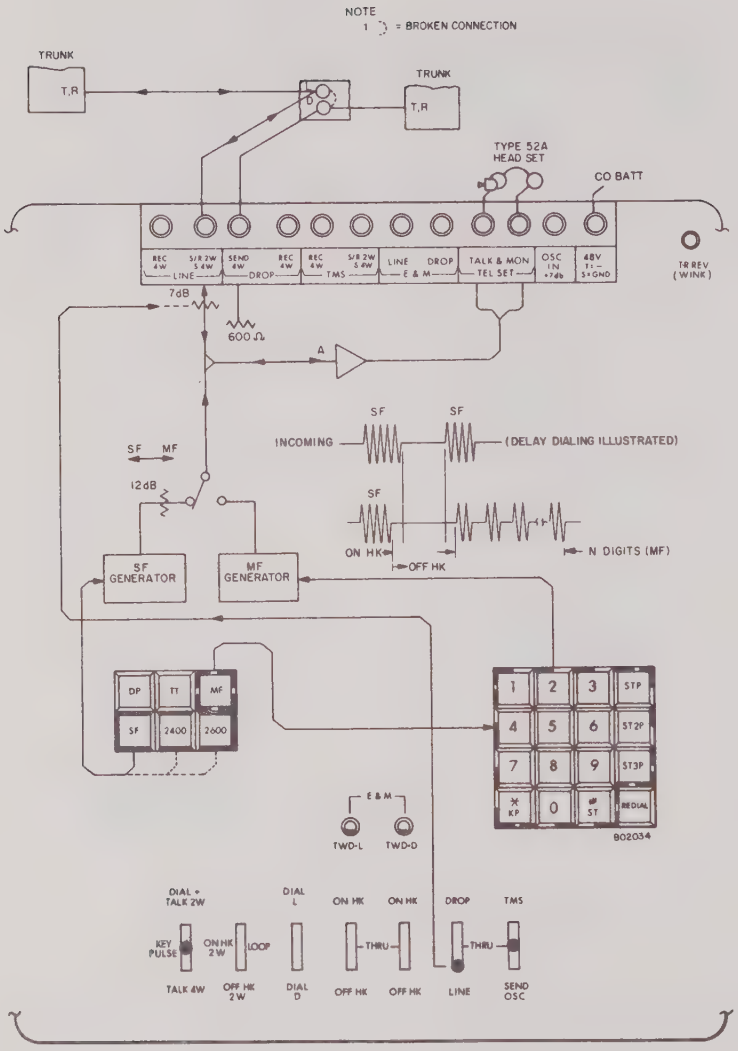

Figure 4—15. Supervision and MF Signaling on Two-Wire Circuit Toward Line.

4.51 **SF Supervision and MF Signaling on a Two-Wire Circuit.**

4.52 Figure 4—15 shows this application as used toward the line and Figure 4—16 as toward the drop and are presented in the following steps. (In-band tone signaling conditions for two-wire circuits are summarized as items 4 and 6 in Table 4—4.)

1. Connect central office battery source to the 48V jack.

2. Connect auxiliary instrument to the test set and energize auxiliary instrument if required.

3. Connect a type 52A telephone headset to the TEL SET jacks if required.

4. Release all pushbuttons in the six-button array.

5. Set all lever switches at their center position.

6. Latch the SF pushbutton.

7. Latch either the 2600 or 2400 pushbutton as required.

8. Set DROP/THRU/LINE switch at LINE or DROP as required.

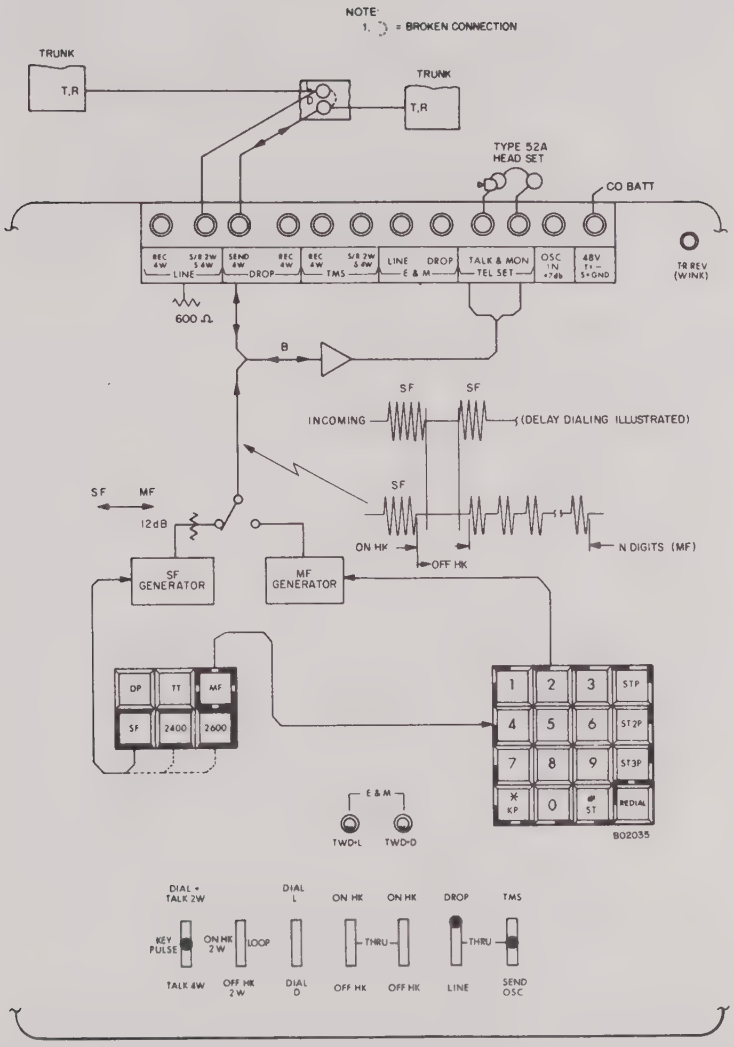

Figure 4—16. SF Supervision and MF Signaling on Two-Wire Circuit Toward Drop.

9. Set POWER switch at ON.

10. Connect the unit to the patch bay as shown in Figure 4—15 or 4—16 as required.

11. Release the pushbuttons in the six-button array.

12. Wait for VF indication that the far end is ready to receive address signals.

13. Latch the MF pushbutton.

14. Use the keypad to send MF tones on the circuit.

15. Communication can be established by setting the DIAL + TALK 2W/KEY PULSE/TALK 4W switch at DIAL + TALK 2W.

16. See paragraphs 4.55 and 4.57 for other operations that can be used at this point in the procedure.

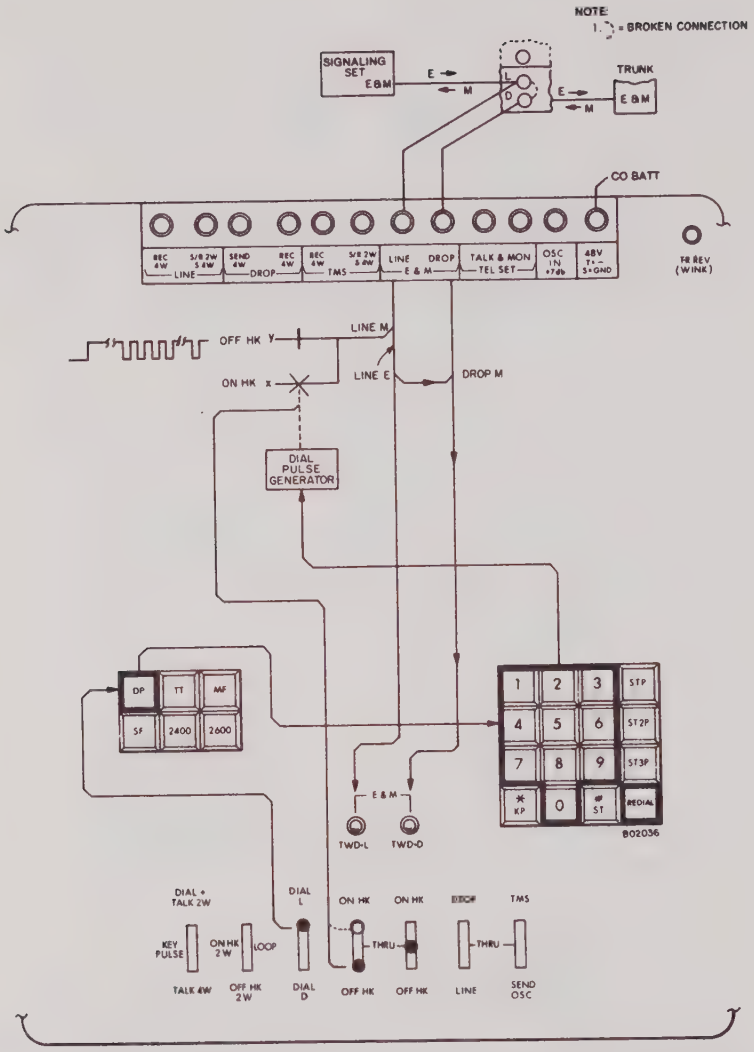

Figure 4—17. E&M Supervision and Address Signaling Toward Line.

4.53 **E&M Supervision and Signaling on Two-Wire and Four-Wire Circuits.**

4.54 Supervision and signaling operations on two-wire and four-wire E&M circuits are illustrated by Figures 4—17 and 4—18 and presented in the following steps. To operate toward the line, use Figure 4—17. Operation toward the drop is shown on Figure 4—18.

NOTE

Before starting this procedure, ensure that internal E&M programming has been set to meet the conditions expected to be found on the circuit under test.

1. Connect central office battery source to the 48V jack.

2. Connect auxiliary instrument to the test set and energize auxiliary instrument if required.

3. Release all pushbuttons in the six-button array.

4. Set all lever switches at their center position.

5. Set POWER switch at ON.

6. Patch the E&M LINE and DROP jacks to the patch bays as required. See Figure 4—17 for operation toward the line and Figure 4—18 toward the drop.

7. Patch the VF jacks as required by testing to be done after sending address signals.

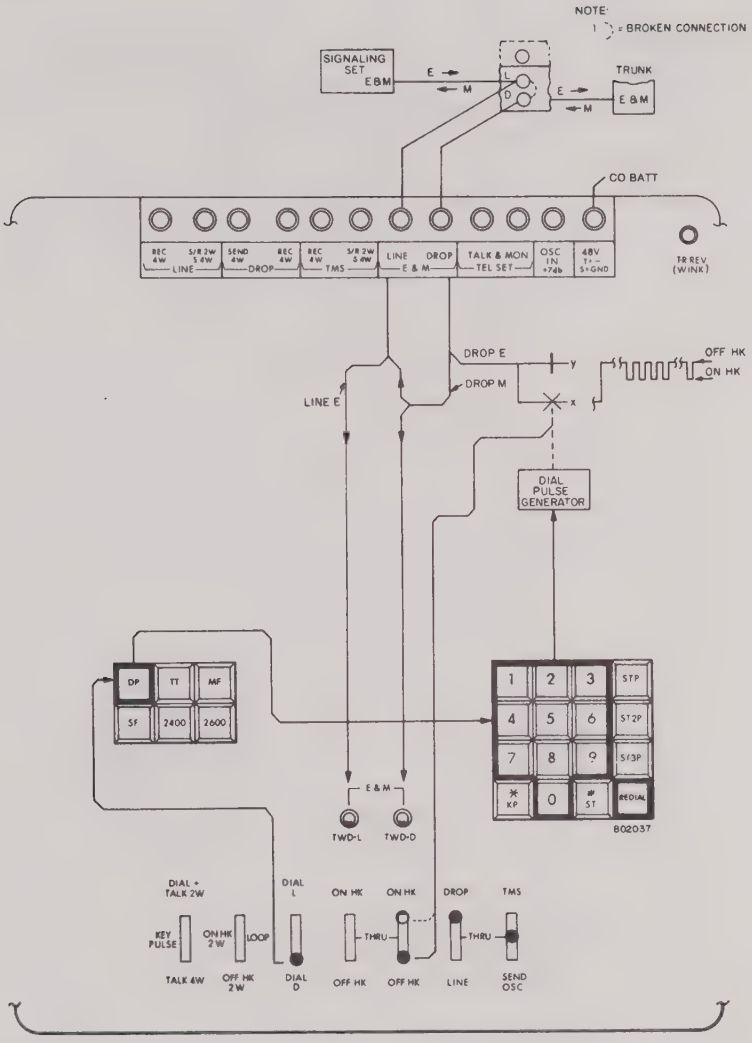

Figure 4—18. E&M Supervision and Address Signaling Toward Drop.

8. If the circuit is idle, set E&M TWD. L or TWD. D ON HK/THRU/OFF HK switch at OFF HK as required.

9. Wait for indication on TWD. L or TWD. D lamp that the far end is ready to receive address signals.

NOTE

If an indication is not received, the received voltage may not be sufficient to trip the threshold circuits.

10. Set DIAL L/CENTER/DIAL D switch at DIAL L or DIAL D as required.

11. Latch the DP pushbutton.

12. Use the keypad to send address signals on the circuit.

13. To use the redial feature, first momentarily set E&M TWD.L or TWD. D ON HK 2W/OFF HK 2W switch at ON HK 2W and return to OFF HK 2W. Then press the REDIAL pushbutton.

14. When the connection has been established, the TMS and oscillator operation described in paragraphs 4.55, 4.57, 4.65, or 4.67 can now be accomplished. In addition, communication can be established by setting the DIAL + TALK 2W/KEY PULSE/TALK 4W switch at the appropriate TALK position.

15. Upon completion of testing, the circuit can be released by setting the E&M TWD. L or TWD. D ON HK/THRU/OFF HK switch at ON HK.

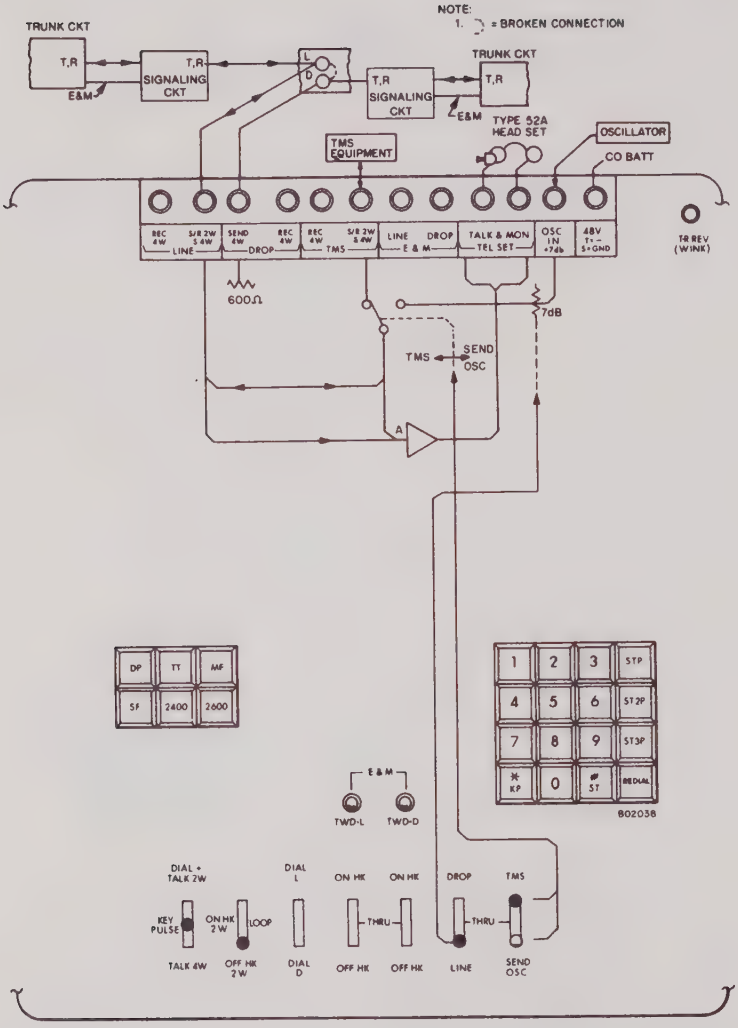

Figure 4—19. TMS and Oscillator Operations on Two-Wire Circuit Toward Line.

4.55 EXTERNAL TMS OPERATION ON TWO-WIRE CIRCUITS.

4.56 Operations using external TMS equipment are illustrated by Figures 4—19 and 4—20 for toward-the-line and toward-the-drop applications respectively and presented in the following steps. (Conditions are summarized as items 8 and 10 in Table 4—4.) This procedure is linked with the two-wire supervision and address signaling presented in paragraphs 4.43 through 4.53 and assumes that the connection has been completed.

1. Connect TMS equipment and set up send and receive circuits.

2. Set DIAL + TALK 2W/KEY PULSE/TALK 4W switch at KEY PULSE.

3. Set TMS/THRU/SND OSC switch at TMS.

4. Incoming milliwatt signals are now switched to the TMS instrument SEND jack. In addition, outgoing signals are routed to the LINE or DROP SEND jack.

5. To re-establish communications after testing, set the TMS/THRU/SND OSC switch at THRU and the DIAL + TALK 2W/KEY PULSE/TALK 4W switch at DIAL + TALK 2W.

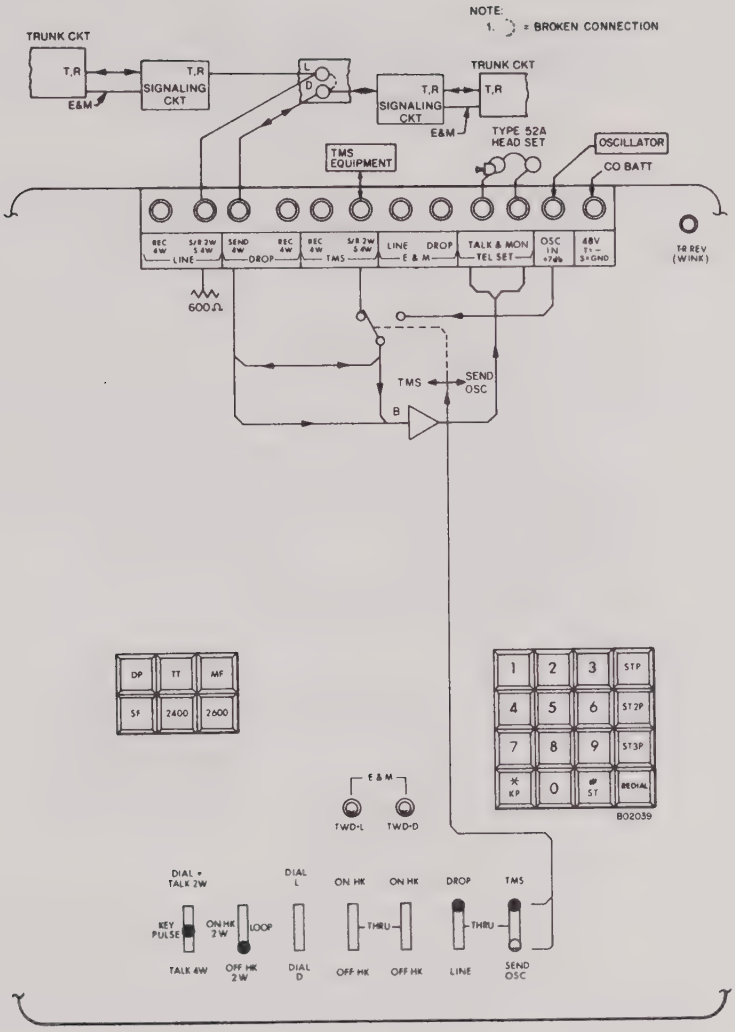

Figure 4—20. TMS and Oscillator Operations on Two-Wire Circuit Toward Drop.

4.57 EXTERNAL OSCILLATOR OPERATIONS ON TWO-WIRE CIRCUITS.

4.58 Operations involving inputs from an oscillator for application to two-wire circuits are illustrated in Figures 4—19 and 4—20 for toward-the-line and toward-the-drop applications respectively and presented in the following steps. (These operations are summarized as items 12 and 14 in Table 4—4.) This procedure is linked with the two-wire supervision and address procedures presented in paragraphs 4.43 through 4.53 and assumes that the connection has been completed.

1. Set oscillator output level at +7 dBm.

2. Set DIAL + TALK 2W/KEY PULSE/TALK 4W switch at KEY PULSE.

3. Set TMS/THRU/SND OSC switch at SND OSC.

4. The oscillator output is now routed to the LINE or DROP SEND jack. The level at these jacks is 0 dBm at the LINE and +7 dBm at the DROP.

5. To re-establish communications after testing, set the TMS/THRU/SND OSC switch at THRU and the DIAL + TALK 2W/KEY PULSE/TALK 4W switch at DIAL + TALK 2W.

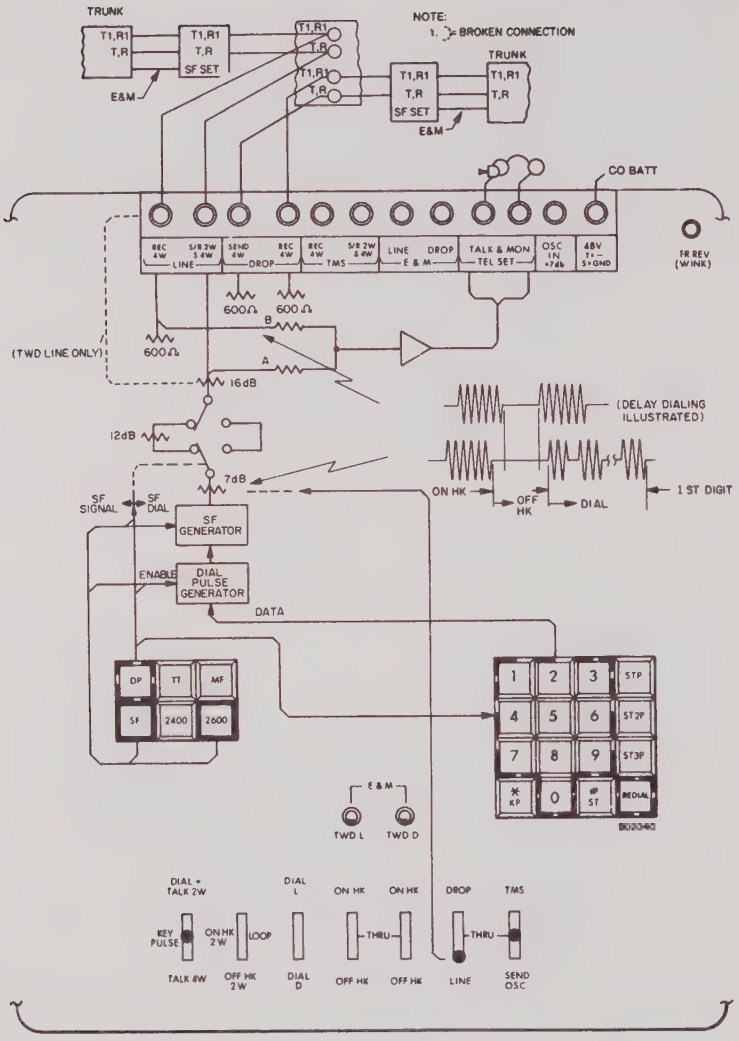

Figure 4—21. SF Supervision and Address Signaling on Four-Wire Circuit Toward Line.

4.59 FOUR-WIRE CIRCUIT SUPERVISION AND ADDRESS SIGNALING PROCEDURE.

4.60 Paragraphs 4.61 through 4.68 provide instructions to supervise, dial and talk on four-wire circuits.

4.61 **SF Supervision and Address Signaling on a Four-Wire Circuit.**

4.62 These operations are illustrated in Figure 4—21 and 4—22 for toward-the-line and toward-the-drop applications respectively and presented in the following steps. (In-band tone signaling conditions on a four-wire circuit are summarized as items 5 and 7 in Table 4—4.)

1. Connect central office battery source to the 48V jack.

2. Connect auxiliary instrument to the test set and energize auxiliary instrument if required.

3. Connect a type 52A telephone headset to the TEL SET jacks if required.

4. Release all pushbuttons in the six-button array.

5. Set all lever switches at their center position.

6. Latch both the SF and 2600 pushbuttons.

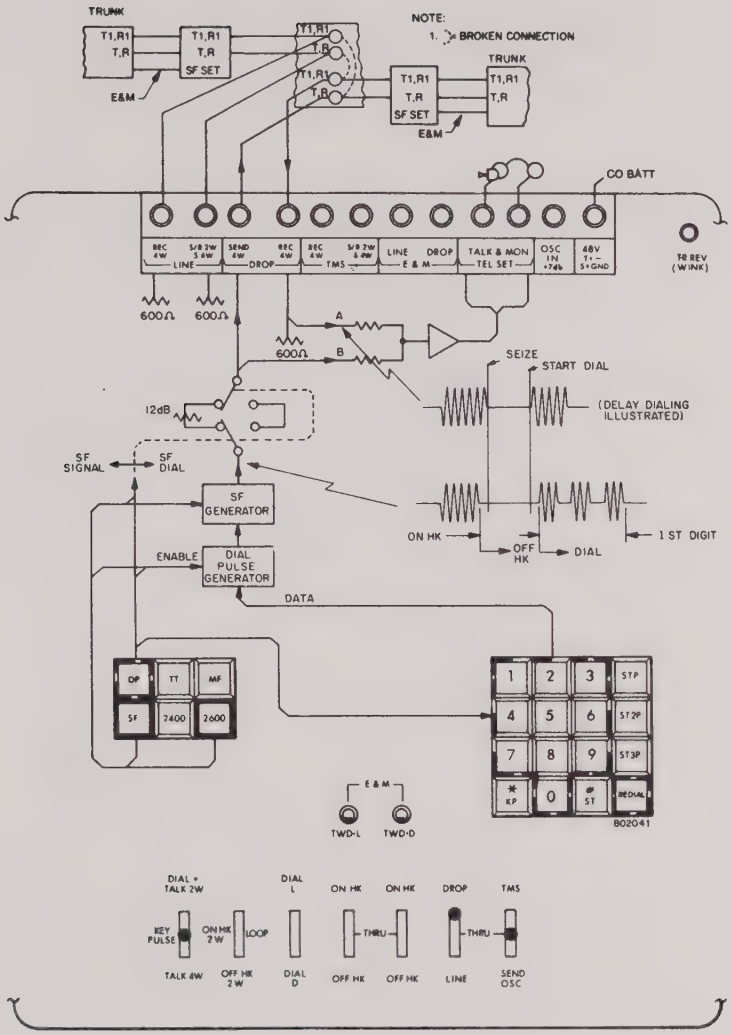

Figure 4—22. SF Supervision and Address Signaling on Four-Wire Circuit Toward Drop.

7. Set DROP/THRU/LINE switch at either LINE or DROP as required.

8. Set POWER switch at ON.

9. Connect the unit to the patch bay as shown in either Figure 4—21 or Figure 4—22 as required.

10. Signal off-hook by latching the DP pushbutton.

11. Wait for a VF indicaiton that the far end is ready to receive address signals.

12. Use the keypad to send SF tone bursts as address signals on the circuit.

13. Communications can be established by setting the DIAL + TALK 2W/KEY PULSE/TALK 4W switch at TALK 4W. Figures 4—25 and 4—26 show the operations for talking of four-wire circuits.

14. Refer to paragraphs 4.65 and 4.67 for additional procedures that can be performed at this point in the procedure.

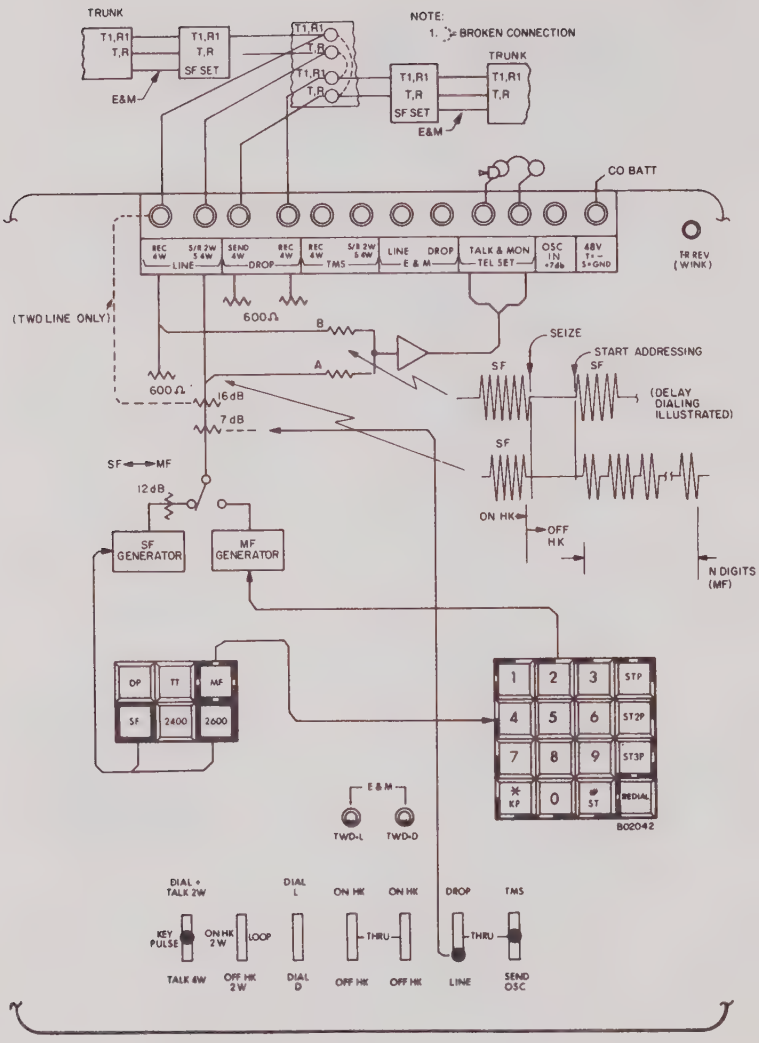

Figure 4—23. SF Supervision and MF Signaling on Four-Wire Circuit Toward Line.

4.63 **SF Supervision and MF Signaling on a Four-Wire Circuit.**

4.64 Operations for these functions are shown on Figures 4—23 and 4—24 for the line and drop applications respectively and presented in the following steps. (In-band tone signaling conditions on a four-wire circuit are summarized as items 5 and 7 in Table 4—4.)

1. Connect central office battery source to the 48V jack.

2. Connect auxiliary instrument to the test set and energize auxiliary instrument if required.

3. Connect a type 52A telephone headset to the TEL SET jacks if required.

4. Release all pushbuttons in the six-button array.

5. Set all lever switches at their center position.

6. Latch both the SF and 2600 pushbuttons.

7. Set DROP/THRU/LINE switch at either LINE or DROP as required.

8. Set POWER switch at ON.

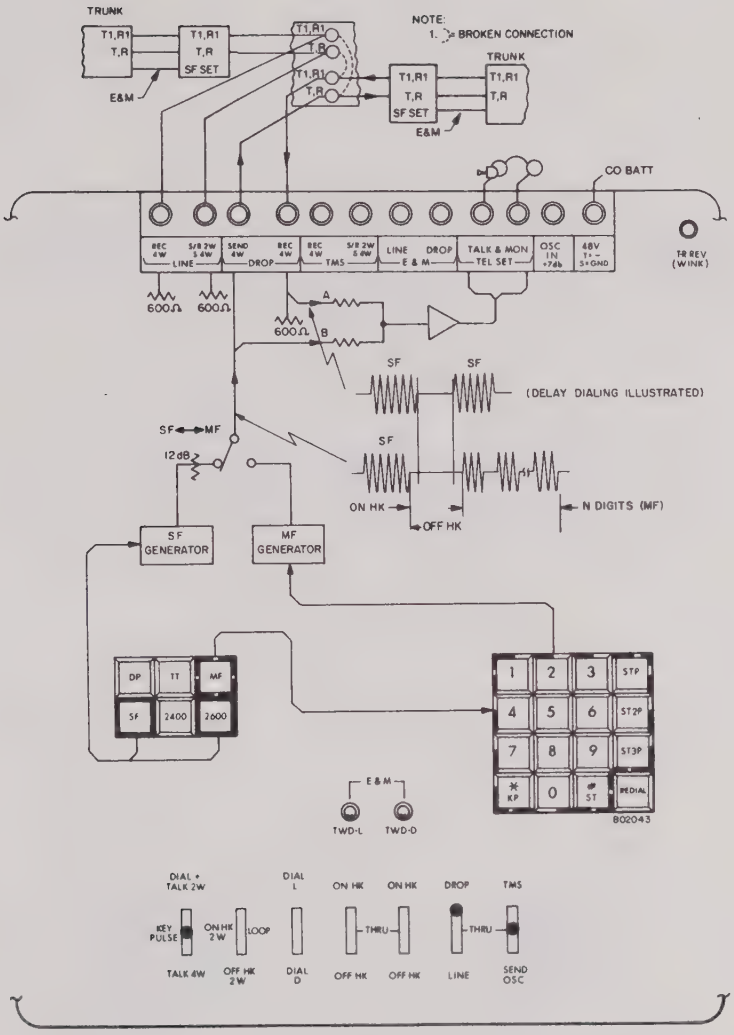

Figure 4—24. SF Supervision and MF Signaling on Four-Wire Circuit Toward Drop.

9. Connect the unit to the patch bay as shown on Figures 4—23 and 4—24 as required.

10. Signal off-hook by releasing both the SF and 2600 pushbuttons.

11. Wait for a VF indication that the far end is ready to receive address signals.

12. Latch the MF pushbutton.

13. Use the keypad to send MF tones on the circuit.

14. Communications can be established by setting the DIAL + TALK 2W/KEY PULSE/TALK 4W switch at TALK 4W. See Figures 4—26 and 4—27 for talking on four-wire circuits.

15. Refer to paragraphs 4.65 and 4.67 for additional procedures that can be performed at this point in the procedure.

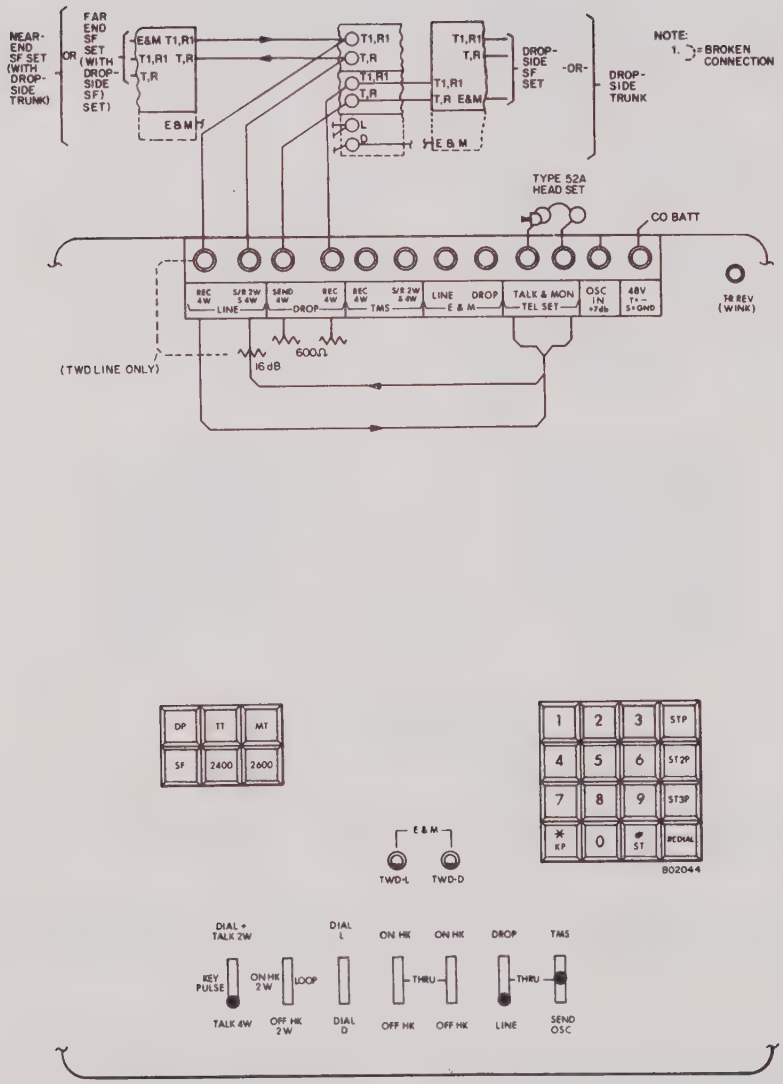

Figure 4—25. Talking on Four-Wire Circuit Toward Line.

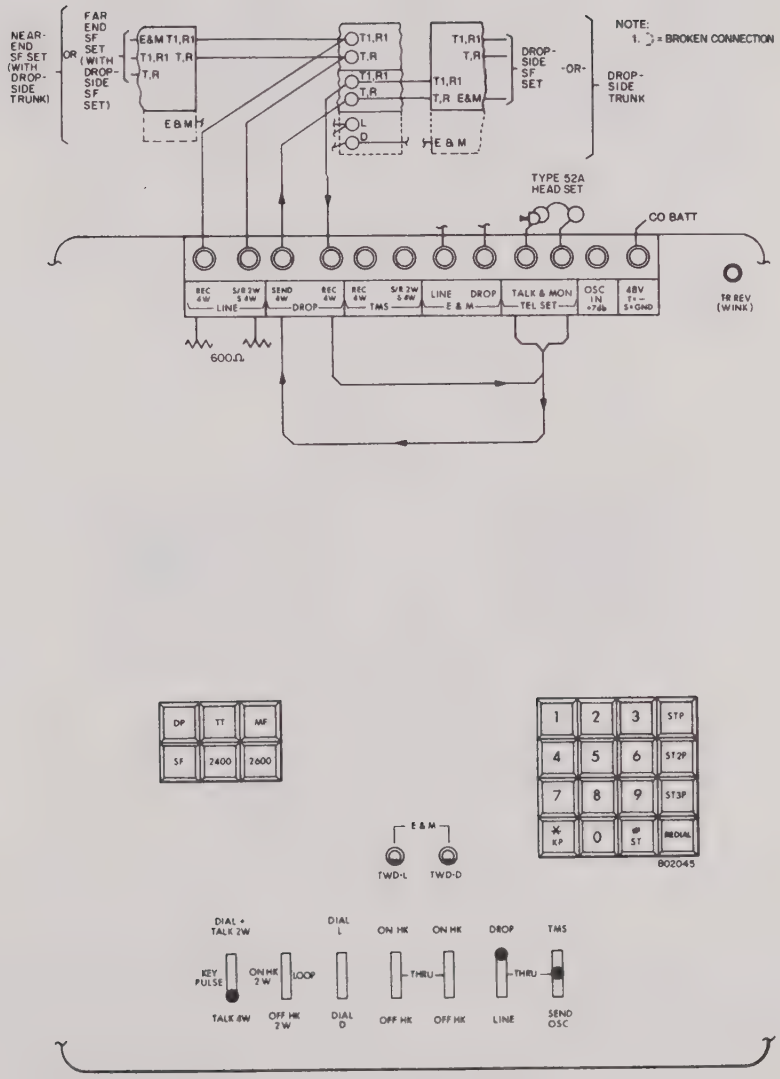

Figure 4—26. Talking on Four-Wire Circuit Toward Drop.

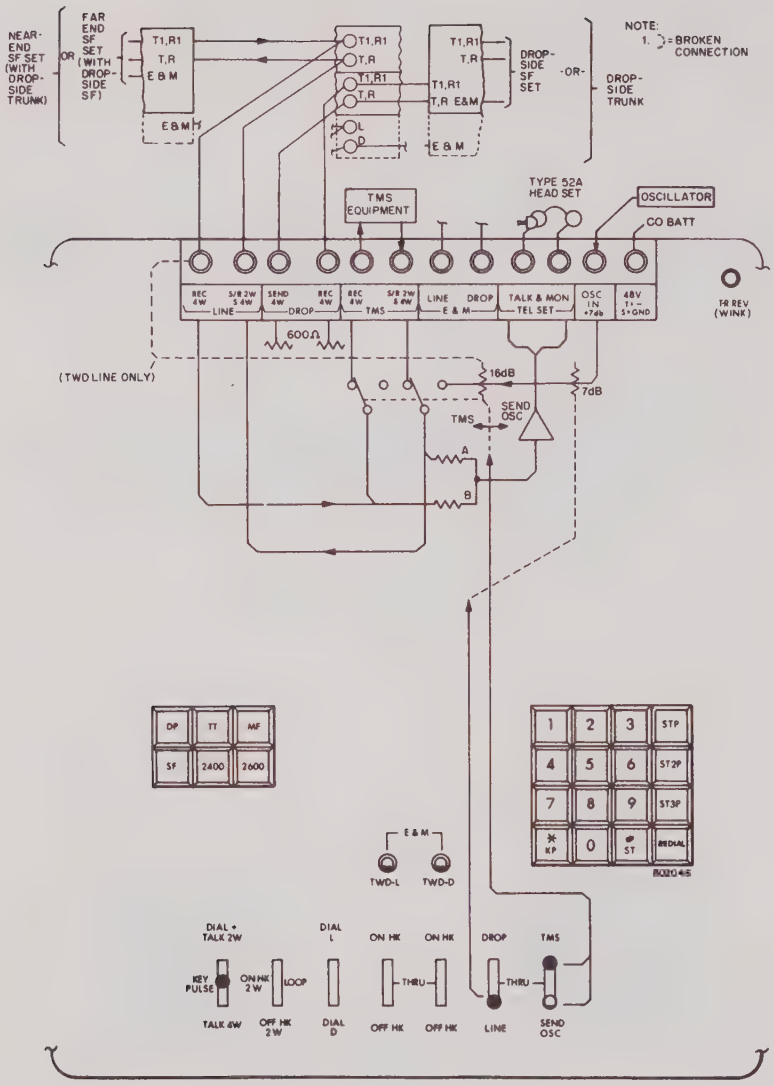

Figure 4—27. TMS and Oscillator Operations on Four-Wire Circuit Toward Line.

4.65 EXTERNAL TMS OPERATION ON A FOUR-WIRE CIRCUIT.

4.66 Operations involving external TMS instruments on four-wire circuits are illustrated on Figures 4—27 and 4—28 for toward-the-line and toward-the-drop applications respectively. (Conditions are summarized as items 9 and 11 in Table 4—4.) This procedure links with four-wire supervision and address procedures given in paragraphs 4.61 and 4.63.

1. Set up TMS instrument send and receive circuits.

2. Set the DIAL + TALK 2W/KEY PULSE/TALK 4W switch at KEY PULSE. TMS operations are always done with this switch set at KEY PULSE.

3. Set TMS/THRU/SND OSC switch at TMS.

4. Incoming milliwatt signals are now routed to the TMS REC jack. In addition, the outgoing signals are routed to the circuit under test.

5. If it is necessary to re-establish communications, set the TMS/THRU/SND OSC switch at THRU and the DIAL + TALK 2W/KEY PULSE/TALK 4W switch at TALK 4W.

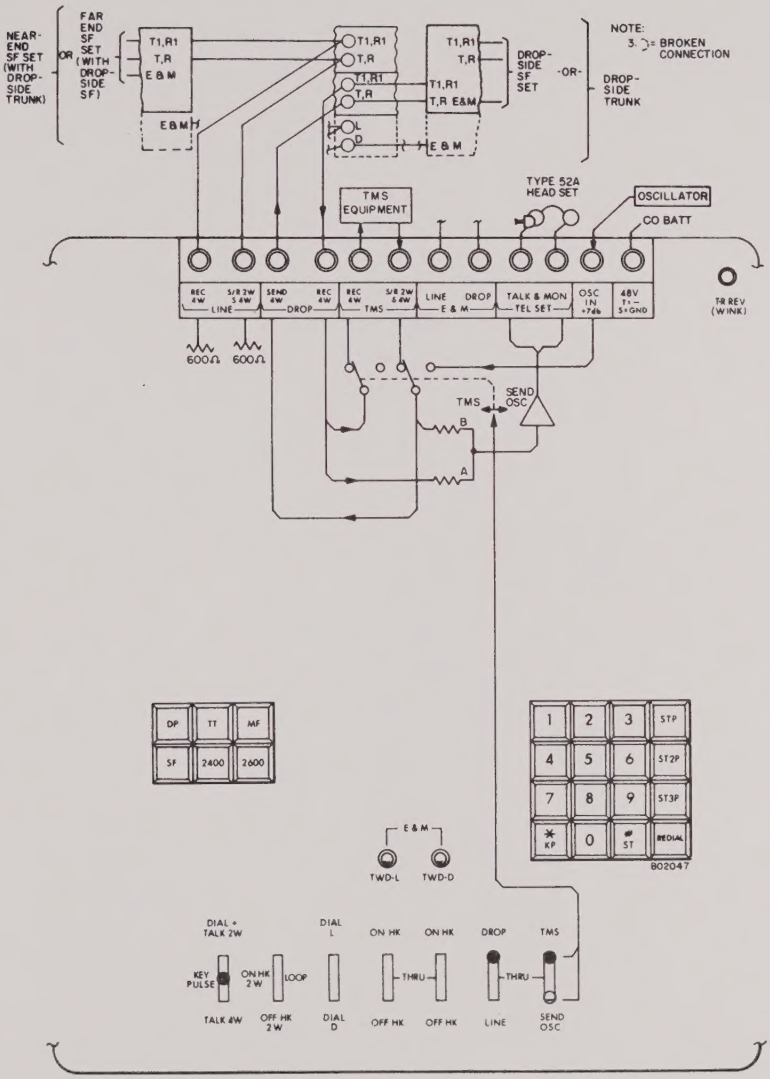

Figure 4—28. TMS and Oscillator Operations on Four-Wire Circuit Toward Drop.

4.67 EXTERNAL OSCILLATOR OPERATIONS ON A FOUR-WIRE CIRCUIT.

4.68 Operations involving oscillator inputs to the TTS 59C for sending into four-wire circuits are illustrated in Figures 4—27 and 4—28 for toward-the-line and toward-the-drop applications respectively. This procedure links with four-wire supervision and address procedures given in paragraphs 4.61 and 4.63.

1. Set oscillator output level to +7 dBm.

2. Set DIAL + TALK 2W/KEY PULSE/TALK 4W switch at KEY PULSE. Oscillator operations are always done with this switch set at KEY PULSE.

3. Set TMS/THRU/SND OSC switch at SND OSC.

4. The outgoing oscillator signal is now routed to the LINE or DROP SEND jack as required. The level is −16 dBm at the LINE jack and +7 dBm at the DROP jack.

5. If it is necessary to re-establish communications, set the TMS/THRU/SND OSC switch at THRU and the DIAL + TALK 2W/KEY PULSE/TALK 4W switch at TALK 4W.

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